

State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Forestry and Wildlife
Honolulu, Hawaii 96813

April 28, 2006

Chairperson and Members
Board of Land and Natural Resources
State of Hawaii
Honolulu, Hawaii

SUBJECT: WAIKAMOI PRESERVE CONTINUED ENROLLMENT IN THE
NATURAL AREA PARTNERSHIP PROGRAM AND AUTHORIZATION
OF FUNDING FOR FY07-12

SUMMARY:

This submittal requests the Board to authorize matching funding for the management of Waikamoi Preserve as part of the Natural Area Partnership Program (NAPP). Although the Natural Area Partnership agreements are made in perpetuity, funding is authorized on a six-year basis to allow for regular periodic State and public review. The current contract is scheduled to terminate at the end of this Fiscal Year, and The Nature Conservancy has prepared a new six-year management plan for Fiscal Years 2007-2012. The Division of Forestry and Wildlife recommends the authorization of matching funding, in the amount of \$1,320,000, to continue conservation management at Waikamoi Preserve for Fiscal Years 2007-2012.

BACKGROUND:

The State's NAPP program was established in 1991 and provides matching funds (\$2 State to \$1 private) for the management of qualified private lands that have been permanently dedicated to conservation (Hawai'i Revised Statutes (HRS) § 195-6.5). Statewide, there are seven preserves enrolled in the program, with three on Maui: Waikamoi Preserve, Kapunakea Preserve, and Pu'u Kukui Watershed Preserve.

Waikamoi Preserve, located on the island of Maui, was established in 1983 and enrolled in the NAPP in 1994. Haleakalā Ranch Company is the private landowner, while The Nature Conservancy holds the conservation easement and manages the property pursuant to previously approved long-range management plans.

ITEM C-3

DISCUSSION:

The NAPP Program seeks to protect, restore, or enhance significant native resources of the State, by providing funding for private landowners to conduct long-term conservation management over private lands of natural area reserve quality. Waikamoi Preserve is an excellent example of a partnership involving the private and public sectors to protect one of the State's best examples of native wet forest ecosystems, and the participation in the NAPP program is partially responsible for the development of the East Maui Watershed Partnership, the oldest watershed partnership in the State.

In 1993, the State Legislature established a dedicated funding source for the program through the dedication of a portion of the conveyance tax. Although the Natural Area Partnership agreements are made in perpetuity, funding is authorized in six-year increments, for the entire term of its approved management plan. Approval of funding to implement the conservation actions proposed in the FY07-12 LRMP, would demonstrate the State's continued strong support and recognition of the importance of long-term natural resources management, demonstrate the program's potential, and potentially attract additional private partners.

The objective of the Protective subzone of the Conservation District is to protect resources in such designated areas as natural area reserves, important watersheds, or plant and wildlife sanctuaries; the objective of the Resource subzone is to develop, with proper management, areas to ensure sustained use of the natural resources of those areas; and the objective of the Limited subzone is to limit uses where natural conditions suggest constraints on human activities. The proposed use of conservation management as described within the Waikamoi Preserve FY07-12 LRMP, continues previously approved activities and is a permitted use within the Protective, Resource, and Limited subzones of the Conservation District according to HAR § 13-5-22 (P-7 Sanctuaries).

Based on the quality of the natural resources protected in Waikamoi Preserve, the effectiveness of past management efforts at Waikamoi Preserve in preserving and restoring this area as an intact native ecosystem, and the leadership The Nature Conservancy's managing staff have demonstrated as part of the East Maui Watershed Partnership and the Maui Invasive Species Committee, staff recommends approval of the FY07-12 LRMP and the authorization of funding in the amounts requested.

RECOMMENDATION:

That the Board of Land and Natural Resources:

1. continue approval of the activities identified in the Waikamoi Preserve FY07-12 LRMP as a permitted use within the Conservation District;

Waikamoi Preserve (TMK 2-3-005-004) includes 5,230 acres and is located primarily in the State Conservation District (Protective, Limited, and Resource subzones), with a portion in the State Agricultural District. The Long-Range Management Plan for Fiscal Years 2007-2012 (“FY07-12 LRMP,” attached as Exhibit 1) provides a more detailed description of the natural resources protected in Waikamoi Preserve and the management activities planned over the next six years. In brief, the Preserve protects a diverse range of natural community types, from lowland shrublands to subalpine forests, and is important habitat for over 22 rare plant taxa, twelve native forest birds and one native seabird, the Hawaiian hoary bat, and a wide array of invertebrates. In addition, Waikamoi contains the upper reaches of many large streams and, with the adjacent Haleakalā National Park and Hanawī Natural Area Reserve, forms the core of the East Maui Watershed, the largest single source of harvested surface water in the State with an average harvested flow of 60 billion gallons per year. Planned management over the next six years will focus on protecting the Preserve’s natural resources. The management emphasis will be ungulate control and weed removal.

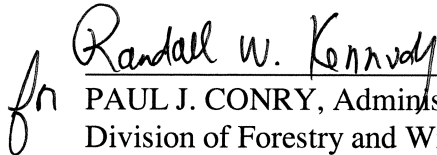
All actions being proposed for reauthorization in the FY07-12 LRMP are substantively similar to, and relevant to, actions previously considered in the Final Environmental Assessment for Waikamoi Preserve, for which The Nature Conservancy received a “Finding of No Significant Impact” in 2000. Pursuant to Hawai‘i Administrative Rule (HAR) § 11-200-13 (Consideration of previously determined and accepted statements), all environmental review obligations under HRS Chapter 343 have been fulfilled and are in keeping with the letter and intent of the Administrative Rules regarding the NAPP program.

The total budget for Fiscal Years 2007-2012 is \$1,860,978. Continuing as a Preserve under the NAPP, the State would provide 2:1 matching funding for the natural area protection efforts outlined in the FY07-12 LRMP. Total State funding requested for Fiscal Years 2007-2012 is \$1,320,000; The Nature Conservancy will provide the match of \$540,978. The total budget is a decrease of approximately \$1,185,024, with an decrease of \$710,667 in the amount requested, over the six-year period and reflects the emergence of the East Maui Watershed Partnership as an distinct entity conducting conservation management in the greater East Maui Watershed region, actions that were previously coordinated by The Nature Conservancy utilizing NAPP funds. Total funding directed to the East Maui Watershed region is anticipated to remain consistent over the next six years, as Natural Area Reserve special funds are anticipated to be used to implement the East Maui Watershed Management Plan through direct support of the East Maui Watershed Partnership field crew.

The FY07-12 LRMP was reviewed by Division of Forestry and Wildlife staff and presented to the Natural Area Reserves Commission on April 3, 2006. The Commission unanimously voted to approve the FY07-12 LRMP and forward it to the Board for its review and approval.

2. authorize the continued funding for the Waikamoi Preserve as part of the Natural Area Partnership Program for Fiscal Years 2007-2012 in the amount requested (\$1,320,000); and
3. authorize the Chairperson to enter into a contract encumbering funds for the Waikamoi Preserve Natural Area Partnership Agreement with The Nature Conservancy for Fiscal Years 2007-2012 with the following conditions:
 - a. the Long-Range Management Plan is accepted for a six-year period; and
 - b. funding is authorized for the full six-year period as described in the Long-Range Management Plan.

Respectfully submitted,


PAUL J. CONRY, Administrator
Division of Forestry and Wildlife

APPROVED FOR SUBMITTAL:

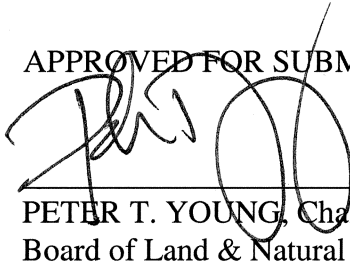

PETER T. YOUNG, Chairperson
Board of Land & Natural Resources

Exhibit 1: Waikamoi Preserve Long-Range Management Plan Fiscal Years 2007-2012

Waikamoi Preserve

East Maui, Hawai‘i

Long-Range Management Plan, Fiscal Years 2007–2012



*Submitted to the
Department of Land & Natural Resources
Natural Area Partnership Program*

*Submitted by
The Nature Conservancy
Hawai‘i Operating Unit
March 2006*

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EXECUTIVE SUMMARY

Waikamoi Preserve is one of two state-funded Nature Conservancy of Hawai'i (TNCH) preserves on Maui. Waikamoi is largely managed and funded under the state's Natural Area Partnership (NAPP) program that provides \$2 state to every \$1 of private funding. Approved for NAPP funding in 1992, this long-range management plan follows an earlier plan covering fiscal years (FY) 2001 – 2006. We request renewal of several management programs over the next six years (FY 2007 - 2012). This plan was prepared in compliance with the NAPP agreement between the state, the Conservancy, and Hawai'i Administrative Rules Chapter 13-210.

We successfully implemented the resource management projects of the previous six-year long-range plan, as well as many others. The primary accomplishments include the following:

- removal of 27 axis deer and 168 pigs from Waikamoi and 84 pigs from East Maui
- 10 miles of fence maintenance or replacement in Waikamoi and 2.5 miles of fence construction assistance in East Maui
- reduction of pig disturbance levels across Waikamoi Preserve
- providing hunter access, threat abatement and monitoring in Ko'olau Gap and Honomanū Units, East Maui
- containment and control efforts for seven priority weed species in Waikamoi
- preventing nine weed species from establishing in Waikamoi including *Miconia*
- locating new occurrences of endangered plant species in Waikamoi and East Maui
- re-design of critical monitoring protocols for Waikamoi and East Maui (with EMWP)
- support for species inventories of forest birds, plants, axis deer, and alien plant research
- educating 9,000 community members and visitors about native forests and Waikamoi Preserve
- enlisting volunteers who contributed over 19,000 hours of stewardship service

In 1989, The Nature Conservancy began an animal removal program focused primarily on pigs and goats, adding axis deer in 1994 after they were observed in Waikamoi. Ungulate control in the last six years brought ungulate damage and activity to low levels

An important accomplishment in last six years was the completion of about 2.5 miles of the East Maui Watershed Partnership (EMWP) fence in neighboring Ko'olau Forest Reserve, which began in 1996. We also initiated management of 8,000 acres of newly enclosed lands, by establishing the first management and access infrastructure. This threat abatement support was not only a direct benefit to these lands, but is essential in maintaining the integrity of both Waikamoi Preserve, Ko'olau Forest Reserve and Hanawā Natural Area Reserve.

For the next six years, Conservancy priority activities in Waikamoi will be ungulate control, weed control, and monitoring of weeds and ungulates.

Starting in FY2007, TNC is collaborating with EMWP to launch a new approach to ungulate management (referred to as "Go Deep"). The goal is to "*dramatically reduce ungulates throughout the 12,000 acre focal area that is fenced to achieve near zero damage and activity levels within 3 years and set up an on-going "no tolerance" management program that will*

maintain near zero damage and activity levels.” TNC will focus its efforts entirely on Waikamoi Preserve, specifically:

1. Units 1A, 1B, and 2,
2. the high elevation snare line that serves as the preserve’s north boundary, and
3. impending serious threats, such as axis deer, looming in the Haleakalā Ranch buffer zone.

An on-going zero-tolerance management regime will be put into place and continued from 2010-2012.

In order to continue our management programs at Waikamoi, this plan requests \$1,320,000 in matching state funds for the six years spanning FY 2007 - 2012 or approximately \$220,000 annually. This project directly supports management at the Waikamoi Preserve and indirectly benefits 15,000 acres of adjacent state and private conservation land, and the entire 100,000-acre EMWP area.

We submit our progress to the NAPP program via written reports and an annual inspection. Operational plans are submitted every 6 months and annually (the Conservancy has adopted a July 1 - June 30 fiscal year). These documents are also available upon request to others who are interested.

Table 1. Overview of Waikamoi Preserve Accomplishments by Programs
FY 2000 – FY 2005

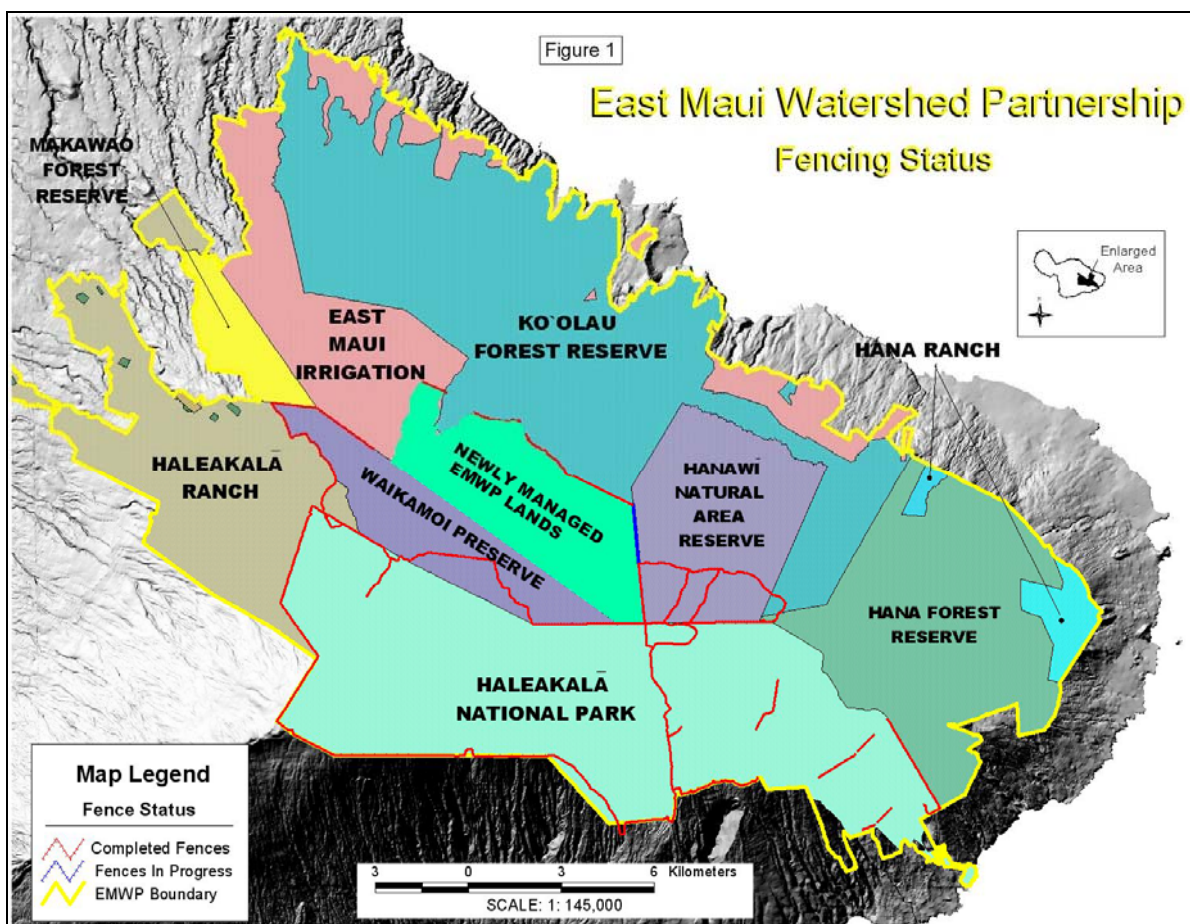
<i>Indicator</i>		<i>Measure of Success</i>
Ungulate Control		
0. Total animal catches		• 168 (Waikamoi) 86 (EM) pigs; 27 deer (Waikamoi)
1. Total snares checked		• 2,000 per year
2. Total hunts conducted		• 50 hunts
3. Miles of fence maintained or replaced in Waikamoi		• 7 miles maintained annually • 1 mile hog wire replaced • 3.5 miles deer fence installed
4. Miles of fence installed in adjacent East Maui		• 2.5 miles
5. Total acres management initiated in East Maui (outside of Waikamoi preserve)		• 8,000 acres
Invasive Plant, Invertebrate and Small Mammal Control		
0. Acres and total numbers of priority invasive plants treated or removed		• 525 acres + 5,227 invasive plants
0. Number of discovered or reported incipient, invasive species eradicated (plant or mammal)		• 13 incipient plant species • no mammal species
0. Acres of satellite miconia populations surveyed and/or treated		• 2,800 acres
Resource Monitoring		
0. Frequency of ungulate sign		• Reduction from 3 to less than 1 percent ungulate activity on transects
0. Acres surveyed for plant infestations		• 200 acres annually
Rare Species Protection and Research		
0. Numbers of new rare taxa discovered		• 12 new rare plant species
0. Numbers of species out-planted and recovered		• 4 rare or endangered species
0. Number of research projects supported in Waikamoi		• 10 invertebrate or plant studies • 3 forest bird studies • 6 non-native species studies • 2 climate studies
Outreach		
0. Total hikes conducted		• 1,198
0. Numbers of visitors or public educated		• 9,000
0. Numbers of volunteers		• 1,337
0. Total volunteer hours		• 19,182

RESOURCE SUMMARY

General Setting

The 5,230-acre Waikamoi Preserve was established in 1983 through a perpetual conservation easement with the landowner, Haleakalā Ranch Company. The forests of Waikamoi are some of the highest quality, most extensive occurrences of Montane Wet Forest and Shrublands in the State of Hawai‘i (TNC ERA 2006) and provide vital habitat for twelve native Hawaiian birds. The preserve lies west of the state's 7,500-acre Hanawī Natural Area Reserve (NAR), and its southern boundary runs along Haleakalā National Park (HALE). These managed areas, together with other state and private lands on the northeast slopes of Mt. Haleakalā, represent one of the largest intact native rain forests in the state, comprising more than 100,000-acres (Figure 1). Waikamoi also provides essential watershed for the island of Maui. The East Maui watershed region is the largest single source of harvested surface water in the state with an average harvested flow of 60 billion gallons per year. Active management of Waikamoi Preserve contributes to the protection of the entire 100,000-acre area. Fire is not considered a serious threat to Waikamoi, because of the high rainfall, high elevation, and year-round wetness of the forest and shrublands.

Figure 1. East Maui Watershed, Existing and Proposed Fences

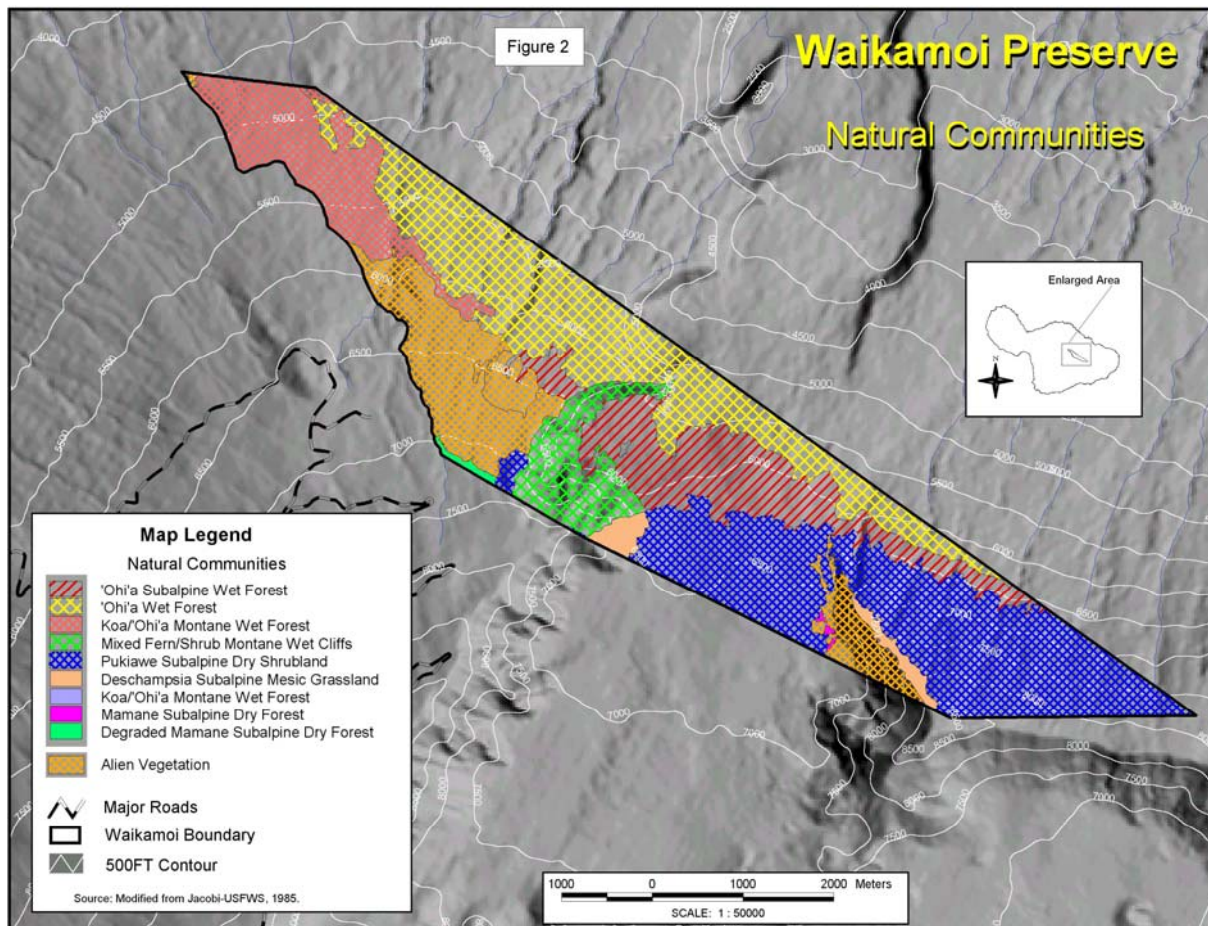


Flora and Fauna

Fourteen terrestrial native natural communities are represented in Waikamoi Preserve, two of which are considered rare: *Deschampsia* Subalpine Mesic Grassland and Māmane (*Sophora chrysophylla*) Subalpine Dry Forest (Figure 2, Appendix 1), and eight of which are also found in the adjacent Hanawā NAR (including the rare *Deschampsia* Subalpine Mesic Grassland). To date, thirty-five rare plants have been reported in the preserve, twelve of which are endemic to East Maui (Appendix 2), and eight of which are formally listed as endangered.

Twelve native birds have been reported from Waikamoi Preserve and of those, seven are federally listed as endangered: ‘ākohekohe (*Palmeria dolei*), Maui parrotbill (*Pseudonestor xanthophrys*), Maui ‘akepa (*Loxops coccineus ochraceus*), po‘ouli (*Melamprosops phaeosoma*), dark-rumped petrel (*Pterodroma phaeopygia sandwichensis*), Maui nukupu‘u (*Hemignathus lucidus affinus*), and nene (*Branta sandvicensis*) (Appendix 3). Four of these endangered native birds also have been reported from the Hanawā NAR. Other more common native birds found in the preserve and Hanawā NAR include ‘apapane (*Himatione sanguinea*), ‘i‘iwi (*Vestiaria coccinea*), ‘amakihi (*Hemignathus virens*), pueo (*Asio flammeus sandwichensis*), and ‘alauahio (*Paroreomyza montana*). The endangered Hawaiian hoary bat (*Lasiurus cinereus*) is found in the preserve and the adjacent NAR.

Figure 2. Waikamoi Preserve Natural Communities



MANAGEMENT CONSIDERATIONS

The Long Range Management Plan (LRMP) outlines the Conservancy's primary activities in Waikamoi Preserve between 2007 and 2012. Those activities specifically proposed for NAPP funding are described in the Management Programs section of this plan.

0. Ungulates, primarily pigs (*Sus scrofa*), threaten the viability of this magnificent biological treasure and vital watershed by destroying the forest floor, eating native species, and serving as vectors for weed invasions and avian malaria. Therefore, an on-going ungulate fencing and removal program was instituted by the Conservancy with NAPP funds in 1989 in Waikamoi Preserve. This program then expanded into parts of the adjacent high elevation forest now managed by the East Maui Watershed Partnership. After a period of transition, the Conservancy is re-focusing its direct management activities on Waikamoi Preserve for the period of 2007 – 2012.

The primary strategy for the protection of Waikamoi Preserve is to reduce damage to native vegetation and soils by removing all ungulates. Over the last six years, the Conservancy's management activities significantly reduced ungulate damage in Waikamoi's management units except in Unit 1A and 2. Unit 1A is accessible to volunteer and contract hunting but this method is inadequate in removing all of the animals. In addition, vandalism of the fence is on-going issue. Therefore, we observe unacceptably high levels of pig damage. "Business as usual" management is expected to lead to chronic, albeit low level, pig activity and damage. To truly contain pig activity and damage and achieve the status of "effectively conserved", new strategic approaches and a zero tolerance approach to ungulate management is warranted.

- A. For the next three years, TNC is collaborating with EMWP to launch a new approach to management (referred to as "Go Deep"). The goal is to "*dramatically reduce ungulates throughout the 12,000 acre focal area that is fenced to achieve near zero damage and activity levels within 3 years and set up an on-going "no tolerance" management program that will maintain near zero damage and activity levels.*"
 - TNC will focus its efforts entirely on Waikamoi Preserve, specifically:
 1. Units 1A, 1B, and 2,
 2. the high elevation snare line that serves as the preserve's north boundary, and
 3. impending serious threats, such as axis deer, looming in the Haleakalā Ranch buffer zone.
 - Intensified, on-going management will be done in all units.
 - New, strategically-located infrastructure (permanent and temporary camps, landing zones, trails) may be installed in under-managed areas.
 - Fences will be inspected more frequently (4-6 times per year and following major storms) with rapid response to discovered problems. The experience of next 2-3 years will inform decisions about additional fencing and units.
 - Snare checks will be intensified. New humane technologies and methods, such as trapping and baiting, and pig tracking devices may be tested.

- Defined timeframes and accountable removal rates will be established for hunting in select Waikamoi units using community-based and/or professional contract hunters. TNC will consider other methods if a formal hunting program does not meet ungulate removal goals.
 - Monitoring will be intensified, as well. In addition to transect monitoring (in units where pig activity is greater than 5%), regular scouting where pig activity and damage is less than 5% will guide control activities.
 - TNC and EMWP will use quarterly meetings for reporting and planning next quarter's activities.
 - A peer review team of experienced resource managers will be established to provide input and serve as outside reviewers. They will meet at 6 month intervals with TNC and EMWP.
 - The Go Deep ungulate control program is intended to serve as a management experiment to see what it takes to reduce the population of pigs to near zero in a concentrated period of time and to test the efficacy of intensified effort. The experience and results of the 3 years will be documented and assessed to determine lessons learned and ways to inform management strategies in other watersheds.
- B. Following completion of Go Deep activities, a no-tolerance management program will be in effect from 2009 – 2012. This will consist of continuing regular fence checks with rapid repairs and on-going scouting with immediate control response if pig activity or damage is detected.
1. With the exception of about 800 acres of introduced pines (*Pinus* spp.) adjacent to HALE's Hosmer Grove area, Waikamoi's 5,230-acres are dominated by native species. Invasive, habitat-modifying weeds, such as kāhili ginger (*Hedychium gardnerianum*) and miconia (*Miconia calvescens*) are serious threats to the forest and shrubland biodiversity. Identification and prioritization of weed species for control is necessary to ensure effective management. Prevention of new weeds and control of the worst habitat-modifying weeds are goals, but controlling established species is extremely challenging, requiring new control techniques. Until new techniques are available, the Conservancy is working to "hold the line" on these established weeds
- A primary management objective is to prevent introduction of habitat modifying weed species. Staff take special care to minimize negative side effects of management activities. Therefore, we follow a strict cleaning protocol for all trucks and gear to remove seeds and insects in order to prevent accidental introduction of pest species to the preserve.
 - Kāhili ginger is established in Makawao Forest Reserve and East Maui Irrigation lands, directly below Waikamoi. The Conservancy has, and will continue, to treat the leading edge of about 1,000 acres of dense infestation, preventing its further spread into Waikamoi. In recent years, the Conservancy assisted in control of Miconia outlier populations closest to Waikamoi to prevent its further spread.
 - Identification and prioritization of additional weed species for control is necessary for Waikamoi. TNC will undertake a threats assessment, using the Conservancy's Conservation Action Planning methodology. This will help us better understand and predict which weed species are likely to threaten specific natural community types

and determine feasible control and prevention strategies. New weed prevention and control actions are anticipated in the next six years. Gorse (*Ulex europaeus*), blackwood acacia (*Acacia melanoxylon*), and invasive pines will species considered for control.

2. Axis deer (*Axis axis*), pose an imminent threat to Waikamoi's forest, as they are established in adjacent Haleakalā Ranch pastures. Axis deer have been observed browsing a variety of native and non-native plant species. Control efforts are underway to prevent their spread into the native forest and shrublands of Waikamoi and the greater East Maui watershed. A 3.5 mile long deer control fence was installed in the pasture from 4,600 ft – 6,500 ft elevation. Monitoring is underway to estimate population size and determine behavior patterns, followed by hunting and baiting strategies. Over the next six years, an on-going control program aimed at complete axis deer removal within this buffer zone will be implemented.
3. Resource monitoring is an important component of management of Waikamoi. The Conservancy will collaborate with EMWP to develop a common baseline threats assessment, a biodiversity and management database and consistent monitoring protocols so that data can be seamlessly analyzed. EMWP and TNC reviewed and revised monitoring methods in November 2005.
 - The Conservancy's ungulate monitoring will be guided by the resulting "East Maui Monitoring Review and Recommendations" and further refinements developed through Go Deep peer review.
 - Objectives and methods for weed monitoring and spatial analysis require further support. The Conservancy will continue searching for a cost-effective, rapid assessment coupled with spatial imagery acquisition for vegetation and weed monitoring.
 - Biodiversity, management, and infrastructure spatial data will be periodically updated.
4. Rare species protection is the goal of the ungulate and weed management activities. These activities provide for passive restoration of endemic and rare species found in Waikamoi through habitat protection. Rare species research support, although important, will not be a Conservancy priority during the next six years, as the focus is on abatement of habitat threats to rare species.
 - We will continue to review and provide technical guidance to researchers as necessary and encourage independent research in Waikamoi by offering necessary application materials to researchers on-line.
 - Although there is no Conservancy funding for research or logistics, wherever possible, we provide technical guidance to approved research. One such project is the Maui Forest Bird Recovery Project's (MFBRP) searches in Unit 1A for possible Parrotbill nest sites from which to collect eggs for captive breeding. The goal of this project is to produce hatchlings in-situ for eventual re-release into protected sites.
 - Staff and contractors will continue to update, map, and expand rare plant, bird and arthropod inventories. This includes updating forest bird location maps based on information from avian studies.

5. The Nature Conservancy will no longer provide a formal outreach program (i.e., school outreach, docent and commercial hike programs). However, we will continue to support the outreach efforts of our partners by providing referral of community member inquiries, and offering advice and materials formerly used in previous programs. Public access to Waikamoi Preserve as a venue for public outreach by appropriate agencies will highlight the importance of protection efforts. Access shall be upon the availability of HALE, EMWP, Hawai'i Nature Center and similar programs to offer Waikamoi as a venue.

Management Units

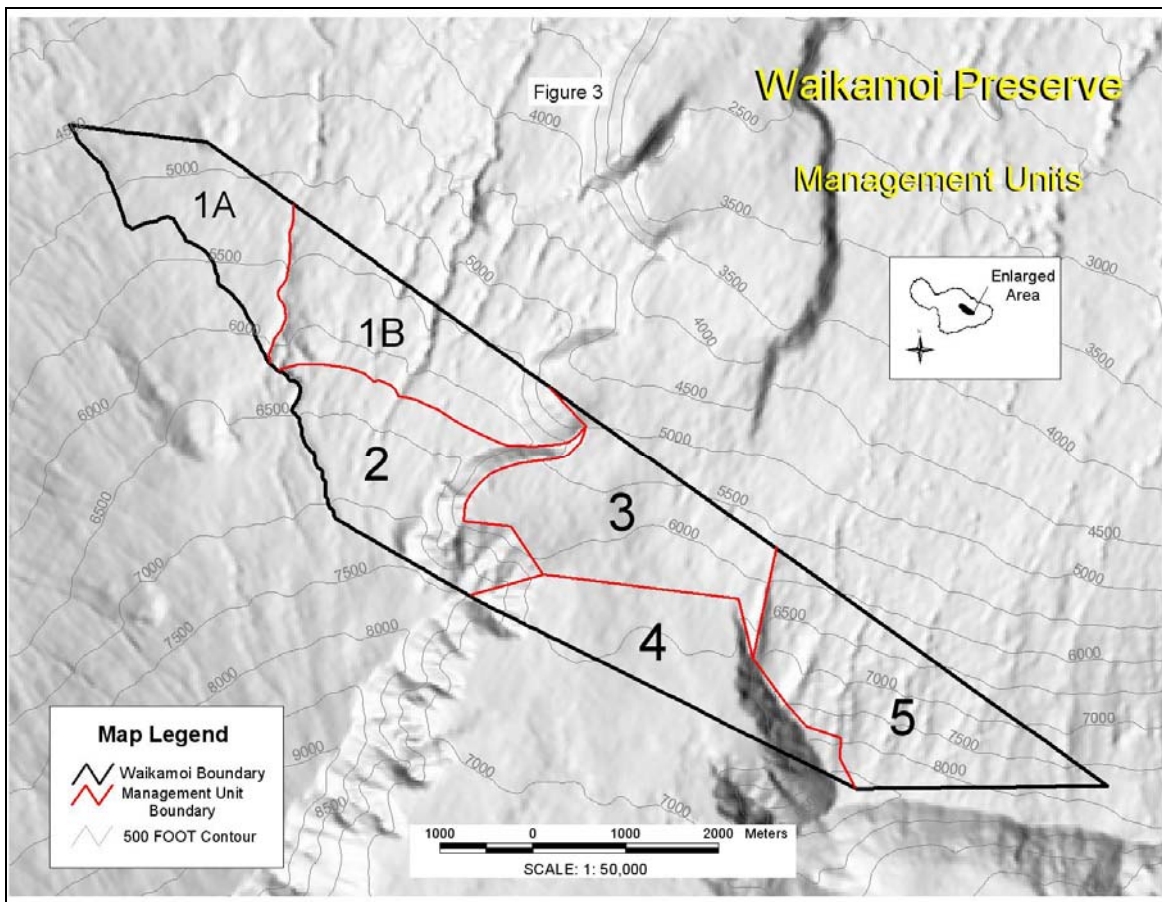
Waikamoi is managed in six units (Figure 3). The units are defined by topographic boundaries, similarity of natural community types, and threats. Topographic features determined the placement of fences built by the Conservancy and HALE. The Nature Conservancy's fences tie into the HALE fence at Pu'u Nianiau and Waikamoi's easternmost tip, and extends downward in elevation. Cooperative agreements with HALE, Haleakalā Ranch, EMI (neighbors along Waikamoi's northeast boundary), the state, and the EMWP allow the Conservancy to work outside the preserve boundaries.

1. Unit 1A is the westernmost portion of the preserve and the lowest in elevation (4,400 feet - 6,000 feet). Its western edge abuts Haleakalā Ranch's open pastureland. It is primarily comprised of Koa 'Ohi'a (*Acacia koa*/*Metrosideros polymorpha*) Montane Wet and Mesic Forest. This is one of the most accessible units. Ungulate management has been limited to hunting, but, as a consequence, has light to heavy pig activity. The unit is entirely fenced except for the eastern boundary, which is formed by the very steep Waikamoi Gulch. 2.5 miles of fence replacement was completed in March 2006 and 1 mile of replacement of deteriorated pasture fence is underway. A deer fence about 500 meters outside Unit 1A in Haleakalā Ranch pasture protects this Unit from axis deer established in nearby Makawao. Fence vandalism is an on-going problem. Unit 1A contains localized infestations of kāhili ginger, blackberry (*Rubus argutus*), tropical ash, gorse, eucalyptus, and pasture grasses (*Poaceae* spp.). This Unit contains persistent pig populations due to the reliance on hunting as the primary tool for control.
2. Unit 1B (5,200 feet t - 6,200 feet elevation) is primarily 'Ohi'a Montane Wet Forest with small patches of 'Akala (*Rubus hawaiiensis*) Montane Wet Shrubland, *Carex* Montane Wet Grassland, and Uluhe (*Dicranopteris*) Lowland Wet Shrubland. Over half of the unit's lower northwest boundary has been fenced. This unit contains breeding populations of Maui parrotbill and 'Ākohekohe, and has been the site of several forest bird research projects. The upper boundary is bordered by conifers and other alien vegetation, and this unit contains small patches of blackberry, ginger, eucalyptus, and conifers. The fence and staff ungulate control have reduced pig activity to under 5% activity levels, requiring further management attention.
3. Unit 2, below HALE's Hosmer Grove, is dominated by dense stands of conifers. Throughout the conifers are many patches of blackwood acacia. All of the gorse in this unit has been treated and only seedlings and occasional re-growth remain (which are routinely treated every 2 to 3 years). The under story is comprised of velvet grass (*Holcus lanatus*) and other alien grasses, with a few native shrubs and ferns. This is also where

blackberry has heavily invaded. However, the gulches that cross this unit are often dominated by native vegetation; some contain populations of the endangered *Geranium arboreum*. There is also a small degraded patch of rare Māmane Subalpine Dry Forest near the center of this unit. The neighboring deer fence in Haleakalā Ranch pasture also protects this Unit from axis deer. This unit also contains light to moderate pig activity due to topographic and forest structure challenges that make removal difficult.

4. Unit 3's upper area is 'Ohi'a Subalpine Mesic Forest. The lower area is predominately 'Ohi'a Montane Wet Forest. This unit contains many rare plants and birds. A small portion of this unit, along the 'Āinahou pali, was once used for summer pasture by Haleakalā Ranch. This formerly grazed area is infested with blackberry and pasture grasses. Pig populations are extremely low, and this Unit has near zero levels of ungulate disturbance.
5. Unit 4 is primarily pioneer vegetation on lava flows and Pūkiawe (*Styphelia tameiameia*) Subalpine Dry Shrubland. The ground is predominately 'ā'ā and pāhoehoe lava. HALE's fence forms Unit 4's north boundary and divides it from the rest of the preserve. Unit 4 is pig free. Large patches of alien grasses can be found throughout Unit 4.
6. Unit 5 is comprised of 'Ohi'a Montane Wet Forest in its lower portions. The larger upper portion is Pūkiawe Subalpine Dry Shrubland, with a narrow band of *Deschampsia* Subalpine Mesic Grassland along the southern boundary below Hanakauhi. This unit extends from 5,600 feet to nearly 8,600 feet elevation. The Conservancy's management activities have dramatically reduced the formerly heavy impact of goats and pigs, with near zero levels of ungulate disturbance. This Unit contains some large patches of blackberry in the easternmost areas.

Figure 3. Management Units of Waikamoi Preserve



Management Programs Funded by NAPP:

FY 2000 – 2005 Accomplishments *and* Proposed NAPP Programs for FY 2007 – 2012

The following management programs are listed in order of priority, with the greatest focus on removing ungulates and habitat-modifying weeds. They are: 1) Non-Native Species Control, 2) Resource Monitoring, 3) Rare Species Protection and Research and 4) Public Outreach. We report on progress made from FY 2000 – FY 2005 and proposed management activities for funding by NAPP FY 2007 – 2012. Staff time and other support expenses are shown separately in the budget summary at the end of this report.

Program 1: Non-Native Species Control

Ungulate Control

Program Goal: To remove all ungulates from Waikamoi Preserve, and prevent future invasion.

This program represents an estimated 85% of the overall effort and budget in this long range management plan.

Program Description: The importance of Waikamoi Preserve as a refuge for twelve native Hawaiian birds, thirty-five rare plants, and seventeen natural communities cannot be overstated. It is one of the most viable and intact remaining native forests in the state. Pig damage is by far the greatest threat to the preserve and critical East Maui watershed headwaters. Therefore, pig control is the focus of the Waikamoi resource management program.

The ungulate control program utilizes a combination of fencing, hunting, and snaring to bring pig populations down to zero as rapidly as possible, and to prevent new populations from becoming established in the preserve. Pigs in particular reproduce at very high rates. Scientific research tells us that seventy percent of the population must be removed annually to maintain lower pig numbers. Snares will continue to be used until an equally effective alternative can be found.

Status of Public Hunting Opportunities. Limited volunteer hunting opportunities are available at Waikamoi. The conservation easement between the Conservancy and Haleakalā Ranch allows ranch employees to hunt. Public hunters willing to follow Conservancy guidelines will be allowed to hunt in Unit 1A of the preserve on a limited basis (when hunting will not interfere with ongoing management activities, planned guided hikes, and hunting by ranch employees.) However, it should be understood that our goal is to remove all ungulates in the preserve, and no area within Waikamoi Preserve will be considered a sustained yield hunting area. There are approximately 50,000 acres available to public hunters below the preserve to meet public hunting needs. Therefore, the Conservancy reserves the right to close Unit 1A and any other management unit in Waikamoi Preserve to hunting.

FY 00 – FY 05: Table 2 provides an overview of our six-year accomplishments.

Table 2. Overview of Ungulate Control Accomplishments

<i>Indicator</i>	<i>Measure of Success</i>
0. Total animal catches	• 168 (Waikamoi) 84 (EM) pigs; 27 deer (Waikamoi)
0. Total snares checked	• 2,000 per year
0. Total hunts conducted	• 50 hunts
0. Miles of fence maintained or replaced in Waikamoi	• 7 miles maintained annually • 1 mile hog wire replaced • 3.5 miles deer fence installed
0. Miles of fence installed in adjacent East Maui	• 2.5 miles
0. Total acres managed in East Maui (outside of Waikamoi)	• 8,000 acres

Pig Removal. To date, we have removed 944 pigs from Waikamoi and East Maui lands. Of these,, 252 are from the past six years. Since 2000, TNC staff removed 168 pigs from Waikamoi and the remote snare line and 84 pigs from Ko‘olau Gap and Honomanu before active management by EMWP (Figure 4). In Ko‘olau Gap and Honomanū an average of 16 pigs were

captured annually, reflecting the onset of management activities. This number will rise in future years, as EMWP puts more acreage under active management.

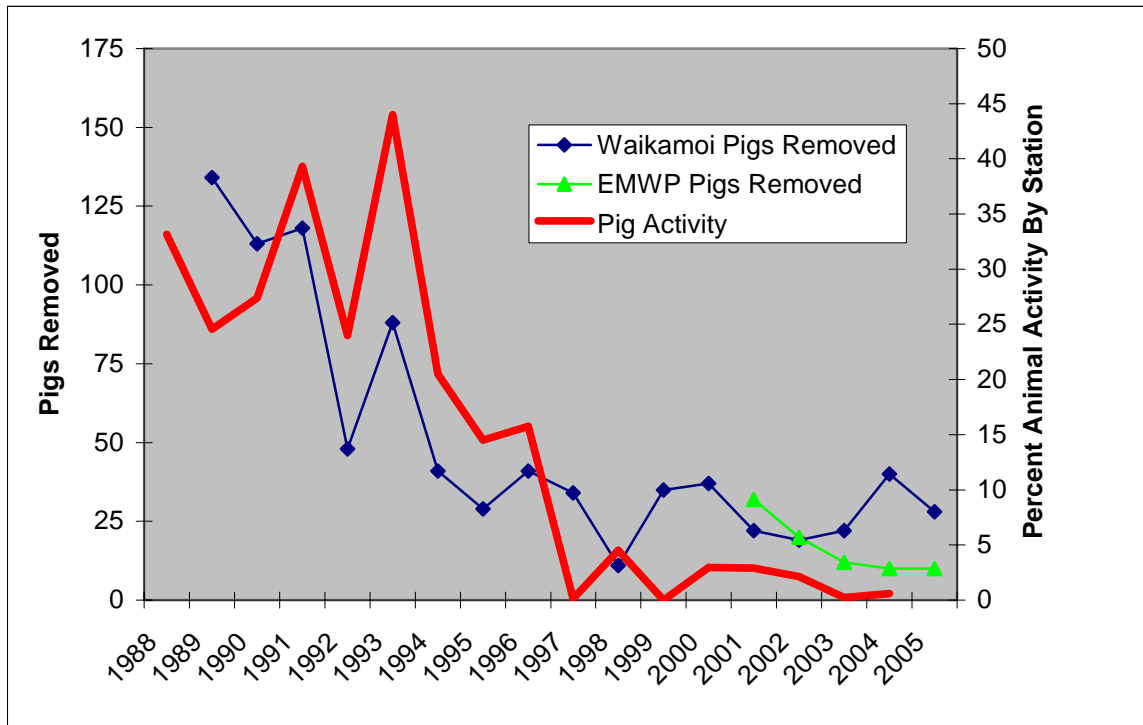
Waikamoi's average pig removal rate of the past six years is about 26 pigs per year, reflecting a preserve that relies on snares (in place of a fence) for its northern boundary and the use of hunting.

In the early 1990s, the Conservancy evaluated the need for fencing Waikamoi across its northern, remote boundary. This high-elevation terrain is highly dissected and difficult to access. Historically, this area supported large numbers of goats and pigs. Staff began animal control efforts by constructing a short section of fence, later abandoning it in favor of a concentrated line of 2,000 snares (Figure 5). There were several reasons for this approach. The same goal of zero pig ingress might be achieved with high numbers of strategically set snares concentrated across a linear distance. Secondly, a well-maintained snare line might avoid the long-term maintenance costs and native species impacts of a fence. Finally, TNC did advocate a fence – but one that was well below Waikamoi that would protect an additional 7,000 acres of prime East Maui Watershed forest.

Consequently, snares were installed presumably at the Waikamoi boundary, without benefit of survey or GPS. When GPS use began, it was discovered that the snare line was actually on East Maui Irrigation lands just below the Waikamoi boundary. For all intents and purposes, the snare line separates Waikamoi from the units managed by the East Maui Watershed Partnership, so the Conservancy continues to be responsible for checking this snare line. Checks were at first quarterly then semi-annually (although snare checks have been infrequent over the past year due to fence replacement in western part of preserve). The Waikamoi ungulate catches from 2000 – 2005 include those from this snare line (Figure 4).

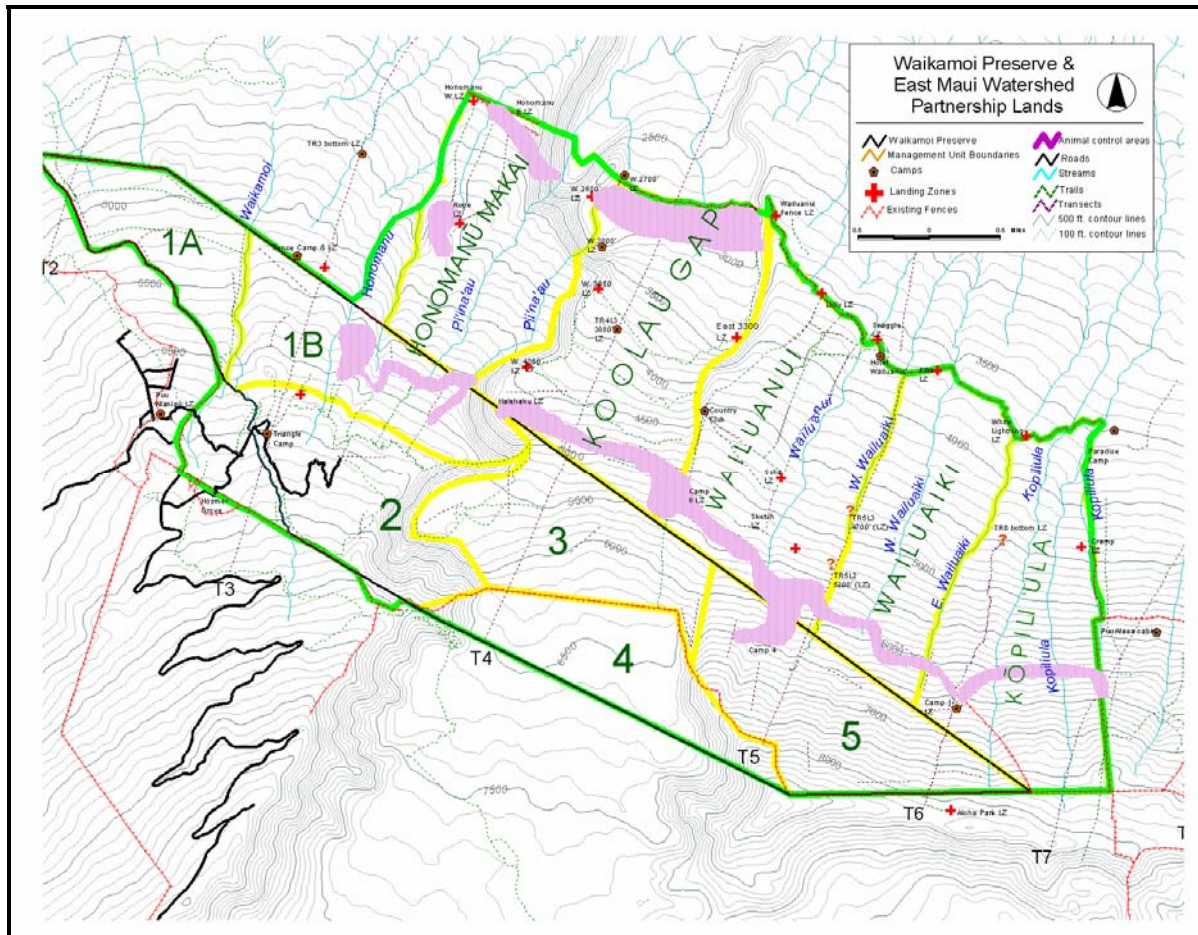
In the coming three years, through Go Deep, the Conservancy will greatly intensify management of this snare line with regular checks and strategic placement. The snare line will also be the staging point for increased scouting and for greater management presence across the remote regions of the preserve. The majority of planned helicopter time is for access to this snare line with an estimated 10-20 trips per year are planned (more trips initially then decreasing). The second three years level of activity will be based on zero-tolerance management guided by scouting.

Figure 4. Pig Activity and Removal Rates, 1988 – 2005



In 1989, a preserve-wide network of transects was completed to measure ungulate activity. Average ungulate disturbance per station on these transects was one third with extensive pig damage to the native vegetation and soils. Simultaneously, snares were placed in the most remote areas of the preserve where no other control method was viable. This control program sharply reduced pig activity. The comparison (Figure 4) of current pig disturbance levels and animals removed to 1989 figures illustrates this major reduction. Recovery of native vegetation has been dramatic. However, experience on the ground indicates that pigs are still present through out all Waikamoi units, including unit 4 which is generally considered “pig free.” Scouting will used to detect pigs where pig disturbance is less than 5%.

Figure 5. Waikamoi Preserve and East Maui Watershed Partnership Lands



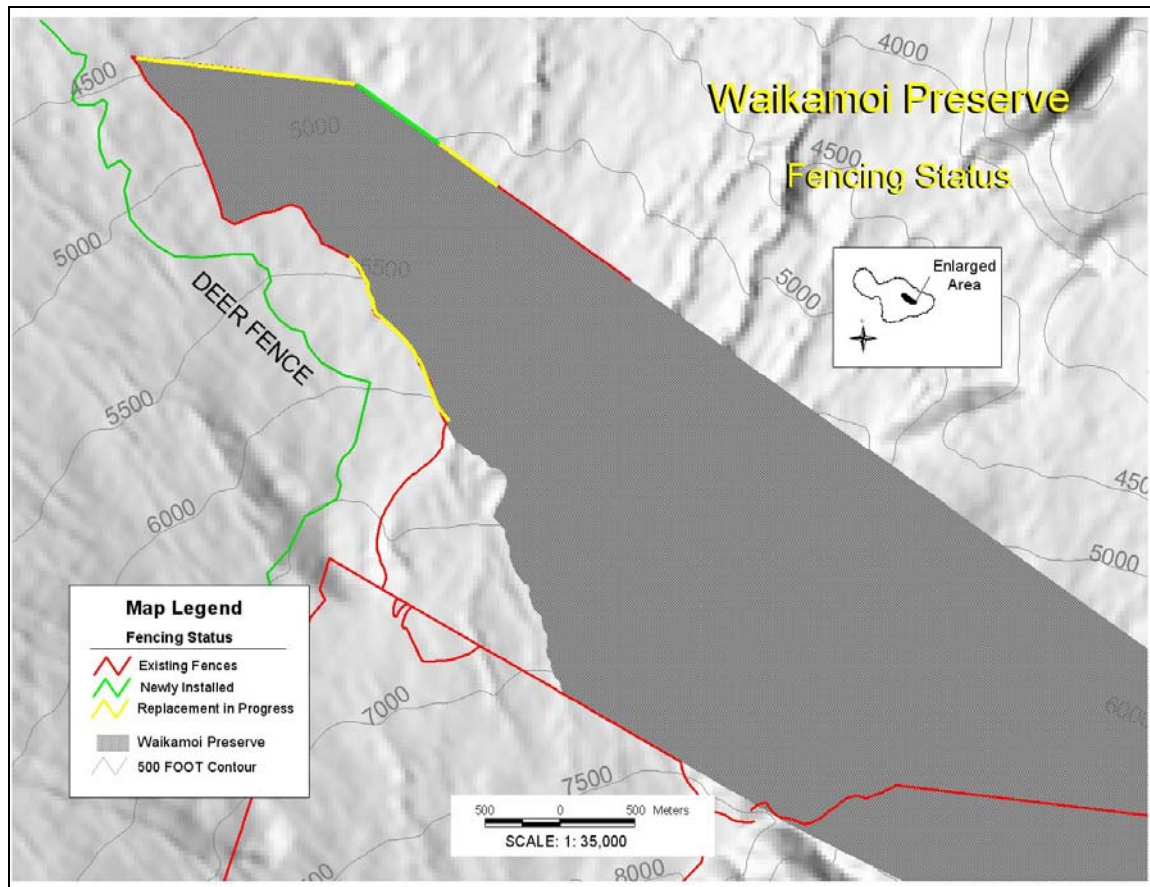
Deer Removal. Deer have been difficult to capture, although 27 have been eliminated both within Waikamoi and on the western Haleakalā Ranch buffer area. In 2000, staff completed this deer removal campaign, and no deer have since been seen in the preserve. Currently, the 3.5 mile deer fence on Haleakalā Ranch pasture outside of Waikamoi provides a deterrent and a buffer zone from their establishment. Removal of remnant deer within this buffer zone is a major goal..

Aerial shooting. We conducted several aerial shoots annually in open shrublands to prevent the re-establishment of both pigs and goats in Waikamoi Preserve (now largely extirpated). A Memorandum of Understanding between HALE and the Conservancy, permits cooperative management by HALE staff for aerial shooting within the National Park and adjacent Waikamoi. On these shoots, the Conservancy pays for the helicopter time dedicated towards Waikamoi Preserve while HALE staff provide the aerial shooting expertise.

Fencing. Waikamoi preserve is approximately two-thirds fenced, and relies on a remote snare line for its northern boundary (2,000 feet below which is the EMWP fence). We maintain seven miles of fence annually (Figures 6), of which we installed four miles of new pig and deer fence. The eight foot deer fence resulted from (1) findings of the Maui Axis Deer Group (MADG) that deer populations were on the upward climb on the entire island, and (2) the discovery of axis

deer in Waikamoi Preserve. It provides an essential, protective barrier to deer populations at the western edge of both Waikamoi Preserve and the entire EMWP.

Figure 6. Fencing Status of Waikamoi Preserve



EMWP support. Ungulate removal in adjacent lands previously under our stewardship is transitioning to EMWP, specifically Honomanū and Ko‘olau Gap. Previously, we installed and maintained the hunting, snaring, and fence infrastructure. This included hundreds of snares, miles of trails, and about a dozen camps and landing zones. We assisted EMWP fence crews in constructing 2.5 miles of remote, helicopter-access-only fence below Waikamoi’s boundaries. These Ko‘olau Gap and Honomanū fences are protective lower barriers for Waikamoi Preserve, which is not fenced in its entirety. EMWP now maintains these fences and removes pigs from Honomanū. They are also slated to do so with Ko‘olau Gap.

FY 07 – FY 12 (NAPP): The focus of our ungulate control program will be three-fold: (1) checking and promptly repairing fences , 2) removal of pigs in Waikamoi Preserve, and (3) on-going hunting of axis deer in buffer zone of the preserve with the goal of total removal.

We will dramatically reduce ungulates throughout the 12,000 acre focal Area that is fenced to achieve near zero damage and activity levels within 3 years and set up an on-going “no tolerance” management program that will maintain near zero damage and activity levels.

Ungulate Removal and “No-tolerance” Management. Snaring in Waikamoi will remain the major ungulate removal tool. In spite of overall low activity levels preserve-wide, both Units 1A and 2 present problems with eliminating the last remaining animals. The current regime of fencing, hunting, and snaring for ungulate removal has a proven track record. Over the next six years, we will test new strategies and techniques so our ungulate control program is as effective, efficient and humane as possible.

Proposed activities include the following:

- Regularly inspect all fences and make repairs immediately. Identify new fencing needs and add strategic fences as needed.
- Regularly check and maintain snares and add new snares in areas of high pig activity and damage
- New humane technologies and methods, trapping and baiting, and pig tracking devices may be tested.
- Prevent invasion of axis deer into Waikamoi Preserve by maintaining deer fence on Haleakala Ranch and conducting regular deer hunts.
- New, strategically-located infrastructure (permanent and temporary camps, landing zones, trails) may be installed in under-managed areas.
- Fences will be inspected more frequently (4-6 times per year and following major storms) with rapid response to discovered problems. The experience of next 2-3 years will inform decisions about additional fencing and units.
- Defined timeframes and accountable removal rates will be established for hunting in select Waikamoi units using community-based and/or professional contract hunters. TNC will consider other methods if a formal hunting program does not meet ungulate removal goals.

Monitoring will be intensified, as well. In addition to transect monitoring (in units where pig activity is greater than 5%), regular scouting where pig activity and damage is less than 5% will guide control activities.

Invasive Plant Control

Program Goal: To control high priority invasive plants in the preserve, and prevent the introduction and spread of problem weeds to areas where they are not currently established.

This program represents an estimated 10% of the overall effort and budget in this long range management plan.

Program Description: The most important aspects of our invasive plant control program are to reduce current disturbances to intact native communities, and to prevent the introduction of additional alien plant species. Elimination of ungulates is believed to be one of the most effective means of controlling the introduction and spread of habitat-modifying weeds. We enforce strict procedures to inspect all equipment and clothing and remove weed seeds and

insects before people enter the preserve. Helicopter flights originate from areas free of aggressive weeds.

Where possible, we use an Integrated Pest Management (IPM) approach to weed control – consisting of manual/mechanical methods, herbicides, or biological control. Cultural control (minimizing soil disturbance and new pest plant introductions) is incorporated into routine field operations. We train staff in the safe handling and application of herbicides by following product label instructions. Actual amounts used are generally well below label listed use rates. We are in full compliance with the state Department of Agriculture’s Pesticide Enforcement Branch. Records are kept for all herbicide use, which is supervised by a Conservancy employee certified through a pesticide branch.

Control work is prioritized. As control is achieved at targeted sites for higher priority species, efforts shift to lesser priorities. For example, success from diligent gorse treatment has led to farther spaced treatment cycles, thus less labor to produce the same results over time.

FY 00 – FY 05: Table 3 below outlines an overview of accomplishments.

Table 3. Overview of Alien Plant Control Accomplishments

<i>Indicator</i>	<i>Measure of Success</i>
6. Acres & total priority invasive plants treated or removed	• 525 acres + 5,227 invasive plants
6. Number of discovered or reported incipient, invasive species eradicated	• 13 incipient plant species
6. Acres of satellite miconia populations surveyed and/or treated	• 2,800 acres

Invasive plant control. We successfully controlled the worst habitat-modifying invasive plants in Waikamoi Preserve while also containing new threats (Figure 7). Successes in Units 1A, 1B and 2 include containment of all known gorse populations, kāhili ginger, tropical ash, invasive acacias and pine trees in the preserve (Table 1). Gorse infestations declined and therefore we re-scheduled treatments from every two to every three years. Other incipient species that were treated in the preserve were alien grasses (*Setaria palmifolia*, *Phleum pratense*), *Tibouchina herbacea*, *Rubus discolor*, English holly (*Ilex aquifolia*), camphor (*Cinnamomum camphora*) and strawberry guava (*Psidium cattelianum*). Finally, we controlled *Eucalyptus* in Unit 2 and blackberry (*R. argutus*) in interpretive areas incidental to other priority weed work. Recently, we also installed boot brushes and signs at entry points to Waikamoi to prevent seed dispersal. We also supported research into improving weed control methods. We did trials to determine the lowest herbicide rate application for effective treatments to determine best practices for maximum efficacy with minimal chemical impact. We tested a ginger bacteria wilt as a biological control of this problem species. While success is limited at this stage, we will continue to support efficacy testing and research to improve tools to combat this highly invasive species.

Outlier control on adjacent lands. Control work expanded to other strategic sites posing a direct threat to the preserve. This included both 1) Haleakalā Ranch pasturelands where pampas grass

(*Cortaderja jubata*) and broomsedge (*Andropogon virginicus*) are potential fire hazards, and 2) East Maui Irrigation (EMI) Waikamoi flume area and Honomanū plateau. Ranch weeds included camphor, St. John's wort (*Hypericum canariense*), various blackberry species, tree poppy (*Bocconia frutescens*), English holly, and faya tree (*Myrica faya*). We also expanded work across the lower elevation wet forest sites below Waikamoi, specifically, ginger and pampas grass search and control. As EMWP has expanded its field presence in EMI, we have handed over this work accordingly.

Outlier miconia containment. A major success was survey and control of all known outlier populations of miconia across 2,800 acres in Haiku, Huelo, Nahikū and Ke'ānae. To date, we have witnessed a major reduction of seedling recruitment as a result of regular site visits. We also hope to transition the management of these sites to the Maui Invasive Species Committee (MISC) and HALE's Exotic Pest Management Team (EPMT), co-controllers of miconia.

MISC support. Finally, we provided major field and operational support to MISC as a developing and now mature operation. We participated as committee member since its inception, assisting with hiring, training, refining weed targets and control strategies. We trained field crews in gear sanitation protocols, participated in alien species outreach, and showcased Waikamoi preserve to invasive species crews to engender appreciation for the natural areas they protect.

FY 07 – FY 12: Maui staff will continue surveying, mapping and controlling Kāhili ginger. We will work with MISC, EPMT, EMWP and Haleakalā Ranch on a coordinated weed approach. (See Appendix 4).

Proposed FY 07 – FY 12 activities include the following:

- Routine weed control of habitat modifying weeds at landing zones, fences, and camp infrastructure.
- Regular control of Kāhili ginger at its leading edge within Unit 1A
- Conduct threats assessment, using the Conservancy's Conservation Action Planning methodology. Identify and prioritize of additional weed species necessary for control and work with others to determine feasible control/prevention strategies.
- New weed prevention and control actions are anticipated in the next six years, but not funded by NAPP. Gorse (*Ulex europaeus*), blackwood acacia (*Acacia melanoxylon*), and invasive pines will species considered for more aggressive control.
- Scout for, map, and monitor potential habitat-altering invasive plants primarily in Waikamoi and on adjacent lands as needed (see Appendix 4).
- Prevent other incipient weed establishment by continuing strict inspection and cleaning procedures to prevent their introduction.

{Note: In general, the Conservancy believes that we can “hold the line” on established alien species for the foreseeable future, but to achieve long-lasting control at the scale necessary new chemical, biocontrol, and mechanical tools and methods need to be developed, which requires research and development that is beyond the scope of our management program.}

Figure 7. Current Weed Status, Waikamoi Preserve and Adjacent Lands, 2005

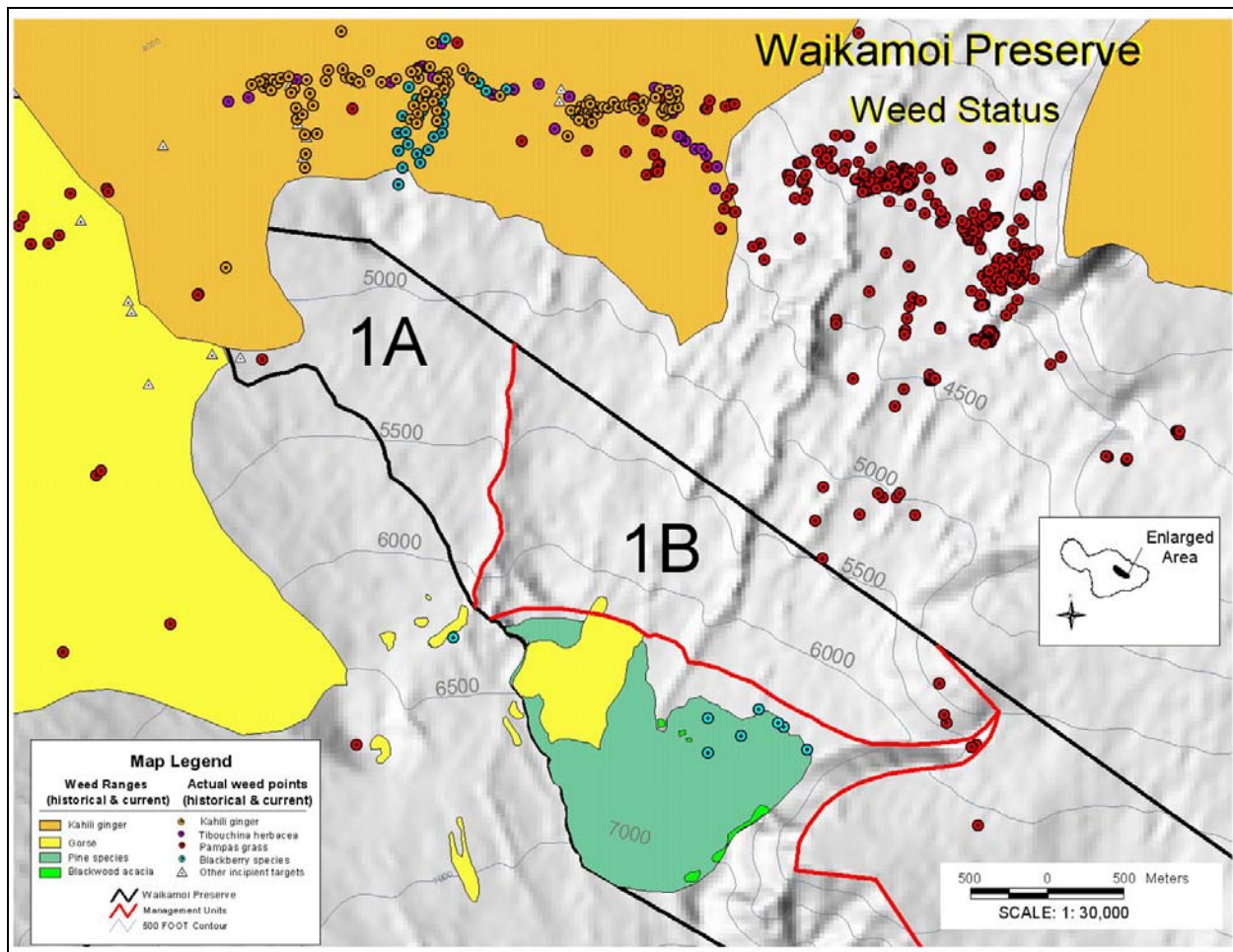


Table 4. Control Estimates for Six Weed Targets in Waikamoi Preserve, FY00 – FY05

	<i>Kāhili ginger</i> (acres)	<i>Gorse</i>	<i>Blackberry</i> <i>species</i>	<i>Blackwood</i> <i>acacia</i>	<i>Tropical</i> <i>ash</i>	<i>Pine species</i>
2000	12	n/a	0.5 acre	85	421	127
2001	25	19	n/a	60	n/a	1100
2002	50	n/a	n/a	152	361	2066
2003	70	n/a	0.2 acre	92	n/a	14
2004	120	27	0.5 acre	570	28	21
2005	200	n/a	0.5 acre	106	n/a	24
TOTAL	477 acres	46 acres	1.7 acres	1,065 plants	810 plants	3,352 plants

Invertebrate and Small Mammal Control

Program Goal: To prevent the introduction of non-native insects, mollusks, and small mammals, and reduce their negative impact where possible.

Program Description: Non-native insects and small mammal damage is evident throughout Maui's native ecosystems. For example, the non-native argentine ant (*Iridomyrmex humilis*) is currently the greatest threat to the survival of the Haleakalā silversword (*Argyroxiphium sandwicense* ssp. *macrocephalum*); it decimates the native yellow faced bee (*Hylaeus volcanica*) that pollinates the plant. Rats, mice, cats, and mongoose pose a threat to many native birds including the endangered ground nesting nēnē. For this reason, we have developed protocols for cleaning and monitoring to prevent the accidental introduction of new alien species.

FY 00 – FY 05: Progress towards invertebrate and small mammal control consisted mainly of following the Alien Species Prevention Protocol as the best means of preventing inadvertent pest introduction. We also provided one-time funding and logistical support in 2000 for a study to assess non-target species risks by proposed aerial applications of rodenticides.

FY 07 – FY 12: Invertebrate and small mammal control is not part of NAPP proposal. We will follow strict established protocols for cleaning and monitoring to prevent the accidental introduction of new alien species.

Program 2: Resource Monitoring

Program Goal: To track biological and physical resources of the preserve, evaluate changes in these resources over time and improve efficacy of management responses.

This program represents an estimated 5% of the overall effort and budget in this long range management plan.

Program Description: The purpose of resource monitoring is to help identify trends or changes to important biological and physical resources over time. Over the years, the monitoring paradigm has shifted from resource-intensive data collection to more a practical approach aimed at answering specific management questions about threat trends.

FY 00 – FY 05: Table 5 below outlines an overview of monitoring accomplishments.

Table 5. Overview of Resource Monitoring Accomplishments

<i>Indicator</i>	<i>Measure of Success</i>
0. Frequency of ungulate sign	• Reduction from 3 to less than 1 percent ungulate activity on transects.
0. Acres surveyed for plant infestations	• 200 acres annually

Ungulate monitoring. Maui staff implemented those monitoring programs dealing specifically with tracking the status of threats to Waikamoi. We completed annual ungulate monitoring on USFWS transects 2 – 6 to determine activity levels across broad areas of both Waikamoi and neighboring lands. In addition, unit-specific transects were also monitored for pig activity. Trend data indicate that overall pig activity observed has declined from about thirty-three percent in 1988 to less than one percent in 2004 (Figure 4). We also tracked pig catch data and created maps from field observations showing the presence of ungulate sign whenever detected. Pig catches have similarly declined, although recent increases are largely due to new snaring within EMWP lands.

Weed and vegetation monitoring. Monitoring of non-native vegetation along five USFWS transects took place in conjunction with ungulate surveys. Data regarding weed taxa and the overall cumulative percent cover of non-native plants per station were recorded. Concerning vegetation sampling, a comprehensive vegetation baseline was done in 1996 on 58 permanent square plots. This was never repeated. While this data provided an index of species found on transects, it gave no indication of their extent throughout the preserve and greater watershed. Instead, we have found that aerial and ground surveys provide the best measure of determining the extent of weeds and provide a visual estimate of ecosystem extent and quality (Figure 8).

Monitoring re-evaluation. From 2004 – 2005, a monitoring working group of the East Maui Watershed Partnership including the Conservancy re-evaluated the current monitoring regime for its usefulness and applicability. We evaluated the 1996 monitoring plan developed for Waikamoi and the greater East Maui watershed that included several intensive programs: (1) plot-based vegetation analysis, (2) ungulate monitoring along miles of U.S. Fish and Wildlife (USFWS) transects and in hunting areas, (3) climate monitoring, (4) miconia and other *ad hoc* weed mapping and monitoring, and (5) water resource analysis, including stream flow, rainfall and water quality. In addition, forest bird continued to take place every five years along USFWS transects.

We discovered that objectives for monitoring were not clear, nor were programs implemented and analyzed with any regularity. We opted for a more realistic and effective monitoring scheme, with an emphasis on several key guidelines: less not more, data used by managers, cost effective, and minimal impact to native ecosystems. The following objectives guided us:

- (0) *Ungulates.* Locate and respond to ungulate activity. Evaluate management actions to reduce this activity. Determine the extent to which ungulate activity objectives are met.
- (0) *Weeds.* Respond quickly to new high-priority invasive species. Determine if high-priority weeds are expanding across the watershed over time. Evaluate program effectiveness in reducing the spread of weeds.
- (0) *Vegetation.* Track changes in the extent and quality of native vegetation cover over the watershed. Answer other specific, data-intensive questions on a smaller, more appropriate spatial scale.
- (0) *Water Resources.* Track changes in the quantity and quality of water resources, including surface, ground, and rainfall. Understand the connection between current management actions in the watershed and water quality and quantity.

Table 6. Summary of 2005 East Maui Monitoring Review and Recommendations.

Ungulate Monitoring Recommendations
<ul style="list-style-type: none"> • Life history data – Record the number, sex, and age of all animal catches. • Managed units with little or no sign – Scout for any sign of ungulate activity along all forest infrastructure annually. Minimum spatial coverage = 25 meters of internal trail per hectare (excluding fenceline scouts). • Managed units with sign – Assess ungulate activity annually on strategically placed transects by recording presence/absence of all ungulate sign in 10m x 5m plots spaced 50 meters apart along each transect. Minimum spatial coverage = 5 meters of transect per hectare. • Unmanaged areas –Inventory biological resources and threats. Use baseline information to propose new managed areas encompassing the highest quality native resources. Analyze and provide adequate spatial coverage of existing ungulate activity monitoring transects in public hunting area below fences.
Weed Monitoring Recommendations
<ul style="list-style-type: none"> • Managed areas – Monitor weeds as appropriate to the specific weed management objectives. Scout for weeds along trails and other infrastructure annually. • Effectiveness – Monitor the efficacy of weed treatments and containment as appropriate.
Vegetation Monitoring Recommendations
<ul style="list-style-type: none"> • Comprehensive vegetation mapping – Map the extent and quality of native vegetation cover across the watershed every 5-10 years using all available aerial and ground-based information. • Helicopter surveys – Implement a pilot low-altitude helicopter survey (vegetation quality, weeds, ungulate activity) for areas “below the fence.” Ensure data are consistent with and feed into vegetation mapping. Develop future recommendations for helicopter surveys based on results of pilot study.
Water Resource Monitoring Recommendations
<ul style="list-style-type: none"> • Existing data collection – Support partners and public agencies to continue collecting data on water resources (i.e., stream flow, ground water, rainfall, water quality) according to their mandates. Discuss with USGS the possibility of increasing the number of active gauging stations in the East Maui watershed. Assist water resource agencies with data collection as time and resources allow.

FY 07 – FY 12: Staff will implement specific monitoring improvements (Table 6) primarily aimed using transects + scouting in units determined to have higher numbers of pigs (Units 1A, 1B and 2) and increasing animal scouting in units believed to have low numbers of pigs. If pig

“hot spots” are discovered, there will be prompt management response. A major change to existing monitoring in Waikamoi is abandoning USFWS transects and vegetation plots to track weeds, ungulates and vegetation changes within the preserve. We did not find this broad-brush monitoring useful in detecting fine-scale changes at the preserve unit level where scouting or strategic transect placement is more effective. Instead, we will re-focus our ungulate transect monitoring in strategic, problem pig areas (Units 1A, 1B, and 2) and add scouting.

Weed monitoring will continue as it has – with a focus on improving weed treatments and scouting for incipient species in Waikamoi. To date, no cost-effective methodology for quantifying weed invasions and respective vegetation changes over time has been developed. We will continue to update maps of estimated weed ranges based on incidental observations. These data will continue to be most useful in providing critical feedback to our management programs.

Proposed activities include the following:

- Track animal catches.
- Update pig activity maps semi-annually.
- Monitor 500 m transects in problem Units 1A, Unit 1B, and Unit 2 or other strategic sites to track ungulate activity.
- Continue to refine the monitoring strategy throughout the preserve with EMWP and the Go Deep peer review team.
- Semi-annual scouting of Units 4 and 5.
- Conduct routine weed scouting and monitor efficacy of treatments. Implement other vegetation and/or weed surveys if cost-effective methods are available.

Program 3: Rare Species Protection and Research

Program Goal: To prevent the extinction of rare species in the preserve, and to encourage research, predator control, and captive propagation of rare plant and bird species.

Program Description: Biological surveys have shown that the preserve protects at numerous rare species, many of which are federally listed as endangered (Figure 8, Appendix 2 and 3). Although protecting essential habitat is our main strategy to their protection, we also inventory the rarest species, and take measures to protect them. The Nature Conservancy identifies rare species according to the Hawai‘i Natural Heritage Program’s definition of rare, that is as “species that exist in fewer than twenty populations worldwide.”

We also encourage and support independent research aimed at answering important resource and management questions. Key questions include: What are the status of forest birds in Waikamoi, and what are the greatest threats to their survival? How do invasive plants spread? How do we best control kāhili ginger? What is the status of deer on Maui?

FY 00 – FY 05: Table 6 below outlines an overview of accomplishments.

Table 6. Overview of Rare Species Protection and Research Accomplishments

<i>Indicator</i>	<i>Measure of Success</i>
0. Numbers of new rare taxa discovered	<ul style="list-style-type: none"> • 12 new rare plant species
0. Numbers of plant species out-planted and recovered	<ul style="list-style-type: none"> • 4 rare or endangered species
0. Number of research projects supported in Waikamoi	<ul style="list-style-type: none"> • 10 invertebrate or plant studies • 3 forest bird studies • 6 non-native species studies • 2 climate studies

Rare plant inventory and recovery. We monitored known populations of seven rare plant species annually for vigor and threats, and undertook threat mitigation (fencing and/or out-planting) for four species (*Peperomia subpetiolata*, *Geranium arboretum*, *Geranium multiflorum* and *Phyllostegia pilosa*). We also contracted out annual rare plant surveys to professional botanists in both Waikamoi and newly managed East Maui lands (Figure 8). An herbarium collection (started in 2004) now houses several hundred plant specimens. As a result, we have identified twelve additional rare plant species in Waikamoi alone. Last year, we teamed up with Haleakalā National Park’s rare plant species recovery program. HALE is in the process of propagating seven rare species found in Waikamoi that no longer occur in the park (Table 7). Under this cooperative program, HALE collects and propagates these species for eventual out-planting into protected areas, including Waikamoi. This will take place in coordination with the Genetic Safety Net protocols established by recovery experts.

Forest bird research. We supported the Maui Forest Bird Recovery Project and the Maui Bird Conservation Center aimed at examining the breeding behavior and population ecology of ‘ākohekohe and Maui parrotbill, and facilitating their recovery. In 2000, we funded a rodenticide study to determine potential impacts to non-target forest birds, aimed at improving rat predation of forest birds. Currently, the U.S. Fish and Wildlife Service is the proponent on a label change to rodenticides that would allow an aerial broadcast. We await this development as ground based rat control is costly.

Other research needs. The Nature Conservancy encourages research that will help us better understand and protect the preserve’s resources. While we are not directly funding research, we encourage independent research projects that require no supervision. We supported numerous research studies in Waikamoi throughout the years (see Appendix 5) including:

- Axis deer history, current status, home range, grouping patterns and species account
- Non-native bird abundance and seed dispersal
- Maui Parrotbill population status and distribution
- Rodenticide testing, rodent density studies, and research on effects to native vegetation
- Entomological survey, life history and taxa identification

Figure 8. Rare Species Locations, Waikamoi Preserve and Adjacent Lands

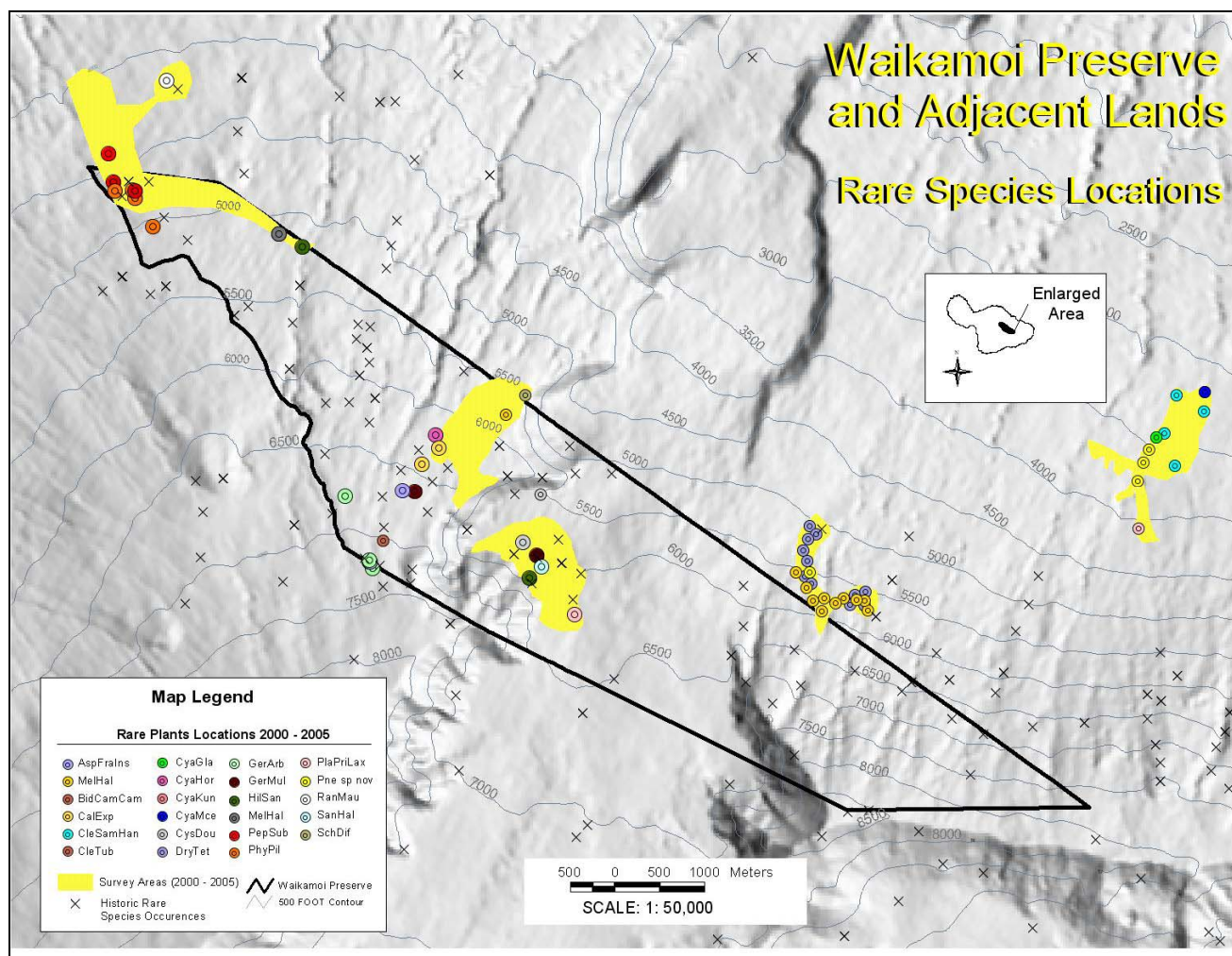


Table 7. Seven Rare Species Targeted for Propagation by Haleakalā National Park in Waikamoi Preserve

Species	Status
<i>Plantanthera holochila</i>	Endangered
<i>Ranunculus mauiensis</i>	Candidate
<i>Geranium arboreum</i>	Endangered
<i>Plantago princeps</i> var. <i>laxiflora</i>	Endangered
<i>Lagenifera maviensis</i>	SOC
<i>Cyanea horrida</i>	SOC
<i>Schiedea diffusa</i>	SOC

FY07 – 12: No NAPP funds are requested for research. We will continue to encourage independent research in Waikamoi by offering necessary applications to researchers on-line and

providing timely review of their proposals. We will provide technical guidance to approved research, as needed.

Program 4: Public Outreach

Program Goal: To build public understanding and support for the preservation of natural areas, and enlist volunteer assistance for preserve management.

Program Description: Sustaining biologically significant native ecosystems throughout the state requires an educated, empowered and mobilized public and private constituency. Our main goal is to increase conservation and advocacy for these areas through an understanding of the importance, threats, and protection efforts of Waikamoi Preserve and the East Maui watershed. The major public outreach tool is hiking in the preserve, although we also cultivate one-on-one contacts, present slide shows, lead hikes and work trips. Haleakalā National Park brings visitors twice weekly into Waikamoi on our most actively used trail, the Bird Loop Trail. The Waikamoi boardwalk constructed in 1995 provides access to pristine native forest and increases interpretation opportunities to an otherwise sensitive ecosystem. The Conservancy-trained hiking docents lead small custom hikes for community and school groups, donors, and community leaders.

Waikamoi's Public Use and Commercial Activity Guidelines provide for limited, low-impact, commercial access on existing Waikamoi trails, consistent with our mission. The primary audience of public access to Waikamoi Preserve is the local community and others who can increase our effectiveness in stewardship. We do not engage in any practice or use that is inconsistent with the long-term survival of vulnerable native species or ecosystems. All revenue generated by these activities is used in support of our management.

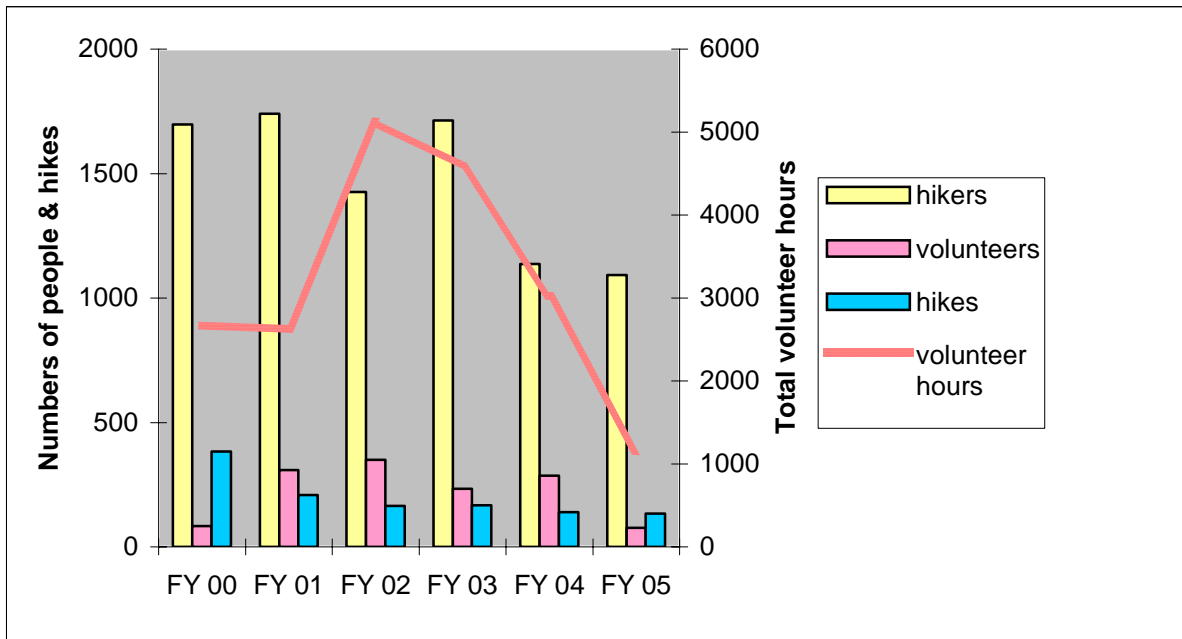
FY 00 – FY 05: Table 8 below outlines an overview of accomplishments.

Table 8. Overview of Public Outreach Accomplishments	
<i>Indicator</i>	<i>Measure of Success (FY 00 – FY 05)</i>
5. Total hikes conducted	• 1198
5. Numbers of visitors or public educated	• 9,000
5. Numbers of volunteers	• 1,337
5. Total volunteer hours	• 19,182

Hikers and the docent training program. A total of 1,198 hikes led nearly 9,000 people in Waikamoi Preserve (Figure 9), mostly as a result of HALE's hikes. We trained hike leaders under the docent program, while making it a self-study course to engage a broader group.

School and public outreach. In total, we participated with 75 groups or events based on Maui (See Appendix 6), including community and professional associations, schools and universities, hula halau, and many others. School participation dramatically increased as a direct result of our Outreach Coordinator. Students learned plant and animal identification, natural and cultural history, preserve management and interpretation with an emphasis on Maui conservation.

Figure 9. Total Contribution of Public Outreach



Summer interns. We made a substantial effort to recruit Hawaiians and long-time residents of Maui in this program. We hired fifteen summer interns to expose high school and college students to careers in conservation. They gave us indispensable labor, while developing work skills and becoming invaluable spokespeople for conservation.

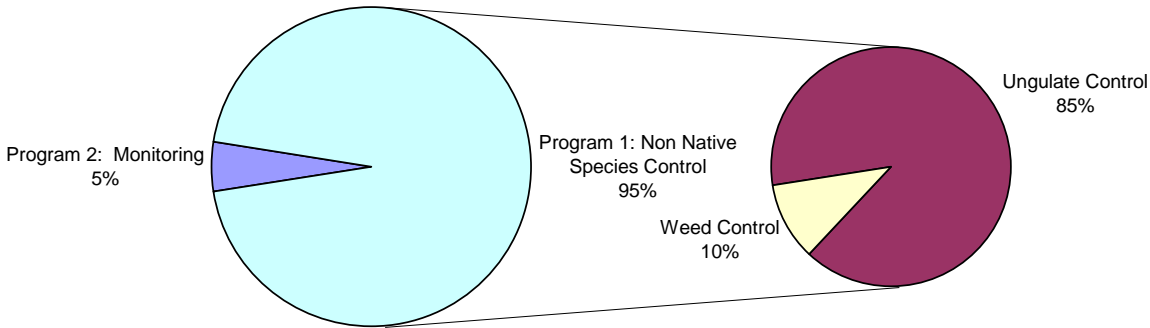
Volunteers. 1,337 volunteers provided 19,182 hours of assistance in ungulates and weeds control, fence and trail maintenance, threat monitoring and recruiting other volunteers. Notably, many of these hours were accomplished on our monthly third Saturday work trips.

Partner support and events participation. Each year, we participated in many public outreach events including Earth Day, community festivals and fairs. For example, each year we handed out 4,800 plants to community members in the Makawao Annual Fourth of July Parade. We also bolstered the developing outreach programs of both the Maui Invasive Species Committee and the East Maui Watershed Partnership. Transferred skills included species identification, resource monitoring, project planning and implementation, fundraising, ungulate and weed control, and working with the media and communities.

The number of volunteer hours declined when the outreach position was eliminated. In March of 2006 the monthly weed control volunteer days were ended, as it was decided that it is more efficient and effective to conduct Kāhili ginger control using staff rather than volunteers.

FY07 – FY12 – No outreach and education activities by the Conservancy are planned for NAPP funds, although the National Park Service and EMWO outreach program will continue to lead walks on Waikomoi Preserve.

NAPP Waikamoi FY07-FY12 Effort/Budget by Program



BUDGET SUMMARY

The following budget summary and table represent the six-year budget for Waikamoi Preserve. Through the NAP program, the state pays two-thirds of the management costs outlined in this long-range plan, up to a total Waikamoi NAPP annual budget of \$330,000 (\$220,000 from the State of Hawai'i and \$110,000 from TNC).

Labor, supply/equipment, travel, subcontract and other expenses associated with TNC's activities within the Waikamoi Preserve will exceed the budgeted amounts in this LRMP. TNC will obtain funding from other sources for these expenses.

Personnel:

This NAPP request will cover a portion of the costs of the Maui Island Program staff that will have responsibilities in implementing the management plan. Other part-time, short-term, or year-to-year personnel may be hired periodically as the budget allows and project needs warrant.

The Personnel line item includes:

A combined effort of Maui's base staff equal to 5.85 FTE.

The Nature Conservancy's currently negotiated (annually with our federal cognizant agency) fringe benefit rate will accrue on all salary/wage costs. The FY07 negotiated rate is 40% for all regular staff and 12% for all temporary staff. These rates are subject to slight change each year.

Technical and annual planning support is also provided by the Honolulu office of the Conservancy. In particular, the Conservation Programs Director, Conservation Programs Coordinator, Conservation Planner, Senior Scientist, and other island resource staff help prepare annual plans and reports, develop and implement monitoring and research programs, and establish interpretive and intern programs at the preserve. As budget and needs allow, these support staff members may charge a small portion of their time to this project.

Supplies and Equipment:

FY07:

Various office and project related supplies and expenses: \$10,000

FY08:

Various office and project related supplies and expenses: \$10,000

FY09:

Various office and project related supplies and expenses: \$10,000

FY10:

Various office and project related supplies and expenses: \$5,000

FY11:

Various office and project related supplies and expenses: \$1,000

FY12:

Various office and project related supplies and expenses: \$1,000

Travel:

A travel budget of \$1,000 has been budgeted each year to cover a portion of staff inter island travel for workshops, training, staff meetings and one mainland trip for 4 staff to attend a workshop.

Subcontracts:

FY07

Helicopter Subcontract - \$36,681

FY08

Helicopter Subcontract - \$20,278

FY09

Helicopter Subcontract - \$11,561

FY10

Helicopter Subcontract - \$7,502

FY11

Helicopter Subcontract - \$2,186

FY12

Helicopter Subcontract - \$5,734

Other:

\$900 has been budgeted each year to cover a portion of miscellaneous project related expenses like communications, printing and photo, training fees, and insurance.

Overhead:

The allowable overhead rate of 10% on NAPP projects has been included on all costs.

BUDGET TABLE

Waikamoi NAPP							
	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	TOTAL
Labor and Fringe	233,385	249,788	258,505	267,564	276,898	273,332	1,559,472
Supplies/Equipment	10,000	10,000	10,000	5,000	1,000	1,000	37,000
Travel	1,000	1,000	1,000	1,000	1,000	1,000	6,000
Subcontracts	36,681	20,278	11,561	7,502	2,168	5,734	83,923
Other	900	900	900	900	900	900	5,400
<i>Subtotal</i>	<i>281,966</i>	<i>281,966</i>	<i>281,966</i>	<i>281,966</i>	<i>281,966</i>	<i>281,966</i>	<i>1,691,795</i>
Overhead @ 10%	28,197	28,197	28,197	28,197	28,197	28,197	169,179
TOTAL	310,163	310,163	310,163	310,163	310,163	310,163	1,860,978
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total
Waikamoi Budget	310,163	310,163	310,163	310,163	310,163	310,163	1,860,978
Match (1/3 of total)	90,163	90,163	90,163	90,163	90,163	90,163	540,978
TOTAL NAPP REQUEST (2/3)	220,000	220,000	220,000	220,000	220,000	220,000	1,320,000

APPENDIX 1

NATIVE NATURAL COMMUNITIES OF WAIKAMOI PRESERVE

NATURAL COMMUNITY NAME	GLOBAL RANK
Lowland	
Uluhe (<i>Dicranopteris linearis</i>) Lowland Wet Shrubland	G4
Montane	
‘Ākala (<i>Rubus hawaiiensis</i>) Montane Wet Shrubland [#]	G3
<i>Carex</i> Montane Wet Grassland [#]	G3
Koa/‘Ōhi‘a (<i>Acacia koa</i> / <i>Metrosideros polymorpha</i>) Montane Wet Forest [#]	G3
Mixed Fern/Mixed Shrub Montane Wet Shrubland [#]	G3
‘Ōhi‘a /Hāpu‘u (<i>Metrosideros polymorpha</i> / <i>Cibotium</i> spp.) Montane Wet Forest	G3
‘Ōhi‘a (<i>Metrosideros polymorpha</i>)/Mixed Shrub Montane Wet Forest [#]	G3
‘Ōhi‘a /‘Ōlapa (<i>Metrosideros polymorpha</i> / <i>Cheirodendron</i> spp.) Montane Wet Forest	G3
‘Ōhi‘a /Uluhe (<i>Metrosideros polymorpha</i> / <i>Dicranopteris</i>) Montane Wet Forest [#]	G3
Subalpine	
<i>Deschampsia nubigena</i> Subalpine Mesic Grassland* [#]	G2
Māmane (<i>Sophora chrysophylla</i>) Subalpine Dry Forest*	G2
‘Ōhi‘a (<i>Metrosideros polymorpha</i>) Subalpine Mesic Forest [#]	G3
Pūkiawe (<i>Styphelia tameiameia</i>) Mixed Subalpine Dry Shrubland	G3
Multizonal	
Pioneer Vegetation on Lava Flow	G3
Subterranean Communities	
Uncharacterized Montane Lava Tube*	GU
Uncharacterized Subalpine Lava Tube*	G1G2
Aquatic Communities	
Hawaiian Intermittent Stream	G4

* Rare natural community

Also known from Hanawh NAR

Key to Global Ranks as defined by Heritage Program:

G2 = Imperiled globally (typically 6-20 current occurrences).

G3 = Restricted range (typically 21-100 current occurrences).

G4 = Apparently secure globally (> 100 occurrences).

GU = Natural community rank uncertain (rank uncertain, provisionally considered rare).

APPENDIX 2

RARE NATIVE PLANTS OF WAIKAMOI PRESERVE

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	FEDERAL STATUS
<i>Asplenium fragile</i> var. <i>insulare</i>		G5T1	LE
<i>Asplenium hobbdi</i>		G1?	R*
<i>Asplenium schizophyllum</i>		G1	SOC
<i>Bidens campylotheca</i> ssp. <i>pentamera</i> +	ko‘oko‘olau, koko‘olau	G2T2	SOC
<i>Calamagrostis expansa</i> #		G2	SOC
<i>Clermontia tuberculata</i> *	‘ōhā, hāhā, ‘ōhā wai	G1	SOC
<i>Cyanea arborea</i> *	‘ōhā, hāhā, ‘ōhā wai	GH	SOC
<i>Cyanea horrida</i> * #	‘ōhā, hāhā, ‘ōhā wai	G2	SOC
<i>Cyanea kunthiana</i> +	‘ōhā, hāhā, ‘ōhā wai	G2	SOC
<i>Cystopteris douglasii</i>		G2	SOC
<i>Diplazium molokaiense</i>		G1	LE
<i>Embelia pacifica</i>	Kilioe	G2	SOC
<i>Dryopteris</i> sp. 3		G1	SOC
<i>Geranium arboreum</i> *	hinahina, nohoanu	G1	LE
<i>Geranium multiflorum</i> * #	hinahina, nohoanu	G2	LE
<i>Hillebrandia sandwicensis</i>	pua maka nui		SOC
<i>Lagenifera maviensis</i>	hōwaiaulu	G2	SOC
<i>Melicope balloui</i> *	Alani	G1	LE
<i>Melicope haleakalae</i> *	Alani	G2	SOC
<i>Microlepia mauensis</i>	Palapalai	G2	SOC
<i>Nothocestrum longifolium</i>	‘aiea	G2	-
<i>Peperomia subpetiolata</i> *	‘ala‘ala wai nui	G1	C
<i>Phyllostegia bracteata</i> + #		G1	C
<i>Phyllostegia haleakalae</i>		G1	-
<i>Phyllostegia pilosa</i>		G1	LE
<i>Phytolacca sandwicensis</i>	pōpolo kū mai	G3	SOC
<i>Plantago princeps</i> var. <i>laxiflora</i>	Ale	G2T1	LE
<i>Platanthera holochila</i> #		G1	LE
<i>Ranunculus mauensis</i>	Makou	G2	SOC
<i>Rubus macraei</i>	‘ākala, ‘ākalakala	G2	SOC
<i>Sanicula sandwicensis</i>		G2	SOC

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	FEDERAL STATUS
<i>Santalum haleakalae</i> *	‘īliahī	G2	-
<i>Sicyos cucumerinus</i>	‘ānunu, kūpala	G1	SOC
<i>Sisyrinchium acre</i>	mau‘u la‘ili, mau‘u ho‘ula ‘ili		-
<i>Wikstroemia villosa</i> +	‘akia	GH	SOC

+ Known only from Maui * Known only from East Maui # Also known from Hanawh NAR

Key to Global Ranks as defined by Hawai‘i Heritage Program:

- G1 = Species critically imperiled globally (typically 1-5 current occurrences).
- G2 = Species imperiled globally (typically 6-20 current occurrences).
- G3 = Species moderately imperiled globally.
- GH = Species known only from historical occurrences (not observed in last 15 years).
- T1 = Subspecies or variety critically imperiled globally.
- T2 = Subspecies or variety imperiled globally (typically 6-20 current occurrences).

Key to Federal Status:

- LE = Taxa formally listed as endangered.
- LT = Taxa formally listed as threatened.
- C = Persisting in cultivation
- SOC = Species of Concern

APPENDIX 3

RARE NATIVE ANIMALS OF WAIKAMOI PRESERVE

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	FEDERAL STATUS
Mammals			
<i>Lasiurus cinereus semotus</i> [#]	‘āpe‘ape‘a, Hawaiian hoary bat	G5T2	LE
Birds			
<i>Branta sandvicensis</i> [#]	nēnē, Hawaiian goose	G1	LE
<i>Hemignathus lucidus affinus</i> [#] *	Maui nukupu‘u	G1T1	LE
<i>Loxops coccineus ochraceus</i> [#]	Maui ‘ākepa, ‘akepeu‘ie	G2T1	LE
<i>Melamprosops phaeosoma</i> [†]	po‘ouli	G1	LE
<i>Palmeria dolei</i> [#]	‘ākohekohe, crested honeycreeper	G2	LE
<i>Pseudonestor xanthophrys</i> [#]	Maui parrotbill	G1	LE
<i>Pterodroma phaeopygia sandwichensis</i>	‘ua‘u, Hawaiian dark-rumped petrel	G2T2	LE

[#] Also known from adjacent Hanawī NAR.

[†] Unconfirmed sighting; known from adjacent Hanawī NAR.

* Known in adjacent areas; thought to occur in Waikamoi.

+ Possible audio sightings on numerous dates between 1973+1979 by P. & W. Banko.

‡ Considered extinct on Maui.

Key to Global Ranks as defined by Hawai‘i Heritage Program:

- G1 = Species critically imperiled globally (typically 1+5 current occurrences).
- G2 = Species imperiled globally (typically 6+20 current occurrences).
- G3 = Restricted range (typically 21+100 current occurrences).
- G5 = Demonstrably secure globally.
- T1 = Subspecies or variety critically imperiled globally.
- T2 = Subspecies or variety imperiled globally.

Key to Federal Status:

- LE = Taxa formally listed as endangered.

APPENDIX 4

PRIORITY WEEDS OF WAIKAMOI PRESERVE (in order of priority)

SCIENTIFIC NAME	COMMON NAME
<i>Hedychium gardnerianum</i>	Kāhili ginger
<i>Ulex europaeus</i>	Gorse
<i>Pinus patula</i>	Mexican weeping pine
<i>Pinus radiata</i>	Monterey pine
<i>Acacia melanoxylon</i>	Blackwood acacia
<i>Fraxinus uhdei</i>	Tropical ash

PRIORITY WEEDS OF WAIKAMOI PRESERVE (not yet established in Preserve)

SCIENTIFIC NAME	COMMON NAME
<i>Acacia mearnsii</i>	Wattle
<i>Andropogon virginicus</i>	Broomsedge
<i>Asparagus asparagoides</i>	Bridal veil creeper; smilax
<i>Bocconia frutescens</i>	Tree poppy
<i>Clidemia hirta</i>	Clidemia
<i>Cortaderia jubata</i>	Pampas grass
<i>Cotoneaster pannosus</i>	Bird berry
<i>Cyathea cooperi</i>	Australian tree fern
<i>Cymbopogon refractus</i>	Barbwire grass
<i>Cytisus palmensis</i>	Canary Island's broom; tasagate
<i>Eucalyptus</i> sp	Blue gum, saligna
<i>Hedychium coronarium</i>	White ginger
<i>Hypericum canariense</i>	St. John's wort
<i>Ilex aquifolium</i>	English holly
<i>Miconia calvenscens</i>	Miconia
<i>Myrica faya</i>	Firetree
<i>Paspalum conjugatum</i>	Hilo grass
<i>Passiflora mollissima</i>	Banana poka
<i>Psidium cattleianum</i>	Strawberry guava
<i>Rubus argutus</i>	Florida prickly blackberry
<i>Rubus discolor (armeniensis)</i>	Blackberry
<i>Rubus niveus</i>	Mysore raspberry
<i>Senecio madagascarensis</i>	Gireweed
<i>Setaria palmifolia</i>	Palmgrass
<i>Tibouchina herbacea</i>	Cane tibouchina

APPENDIX 5

SUMMARY OF SUPPORTED RESEARCH IN WAIKAMOI PRESERVE

Research Topic	Research Team	Dates
Yellow-faced bee (<i>Hylaeus</i> spp.) foraging and food preference study	Karl Maganacca, Cornell University	2000
Introduced mosquitos (<i>Culex</i>) and native aquatic invertebrates	Dennis LaPointe	2000
Assessment of non-target risk to native Hawaiian forest birds from broadcast aerial application of Diphacinone rodenticides	Peter Dunlevy, National Wildlife Research Center	2000
DNA analysis of <i>Hillebrandia sandwicensis</i>	Mark Tebbit	2000
<i>Scotorythra</i> spp. moth larvae study	Mandy Heddle, UC Berkeley	1995-2000
Axis deer on Maui: history, current status, home range, grouping patterns and species account	Steve Anderson, UC Davis	2000-2003
Forest bird research support in Hanawā	Maui Forest Bird Recovery project	2000
Kāhili ginger <i>Ralstonia</i> bacterium assistance	U.S. Geological Survey	2001-current
<i>Tetragnatha</i> spider web architecture	Todd Blackledge, UC Berkeley	2001
<i>Tetragnatha</i> spider egg case morphologies	Joseph Spagna, UC Berkeley	2001
Significance of fog drip contribution to stream flow	U.S. Geological Survey	2001-2004
Happy face spider (<i>Theridion</i>) and <i>Tetragnatha</i> population genetics and evolution	Rose Gillespie, UC Berkeley	2002-current
<i>Acacia koa</i> - phylogenetic studies of koa symbionts	James Leary, University of Hawai'i	2003
Weed dispersal by non-native birds	Jeff Foster, U.S. Geological Survey	2003-current
Introduced <i>Trechus</i> beetle survey	James Liebherr, Dan Polhemus, Will Haines	2003
Maui Parrotbill (<i>Osuedonestor xanthophrys</i>) population status and distribution – Unit 1A	Maui Forest Bird Recovery Project	2004 - current
Endemic sap beetles studies	University of Western Ontario	2004
<i>Dubautia</i> species adaptive radiation	Rancho Santa Ana Botanic Gardens	2004
Tree line dynamics modeling in subalpine shrubland.montane wet forest ecotone	Maaik Bader, Wageningen University	2005
<i>Agryrodes</i> spp. kleptoparasitic spider – foraging, scavenging and pray captures. Mating behavior of host spider <i>Orsonwelles</i> spp.	Rebecca Carter, UC Berkley	2005
Effects of rats (<i>Rattus</i> spp.) on vegetation and invertebrate fauna	Aleksandra Maljkovic, University of East Anglia	2005

APPENDIX 6

SUMMARY OF ORGANIZATION AND EVENT PARTICIPATION IN PUBLIC OUTREACH

- American Association for the Advancement of Science
- Brazilian Capoeira School of Maui
- Carden Academy
- Catherine Blaine and Garfield High School (Seattle, WA)
- Christ the King School
- East Maui Taro Festival
- Emmanuel Lutheran School
- Friends of Moku‘ula
- Gustavus Adolphus College (MN)
- Haleakalā National Park
- Haleakalā Waldorf School
- Hanā High School
- Hāna School and Public Library
- Hawai‘i Nature Center at ‘Īao
- Hawaiian Canoe Club
- Hawai‘i Environmental Educators Association
- Hawai‘i Outdoor Circle
- Hui Mālama Enhanced Learning Center
- Hula Grill Restaurant
- Hula hālau Ke Aka o Ja Nauke
- Kalama Intermediate School
- Kamehameha Schools
- Kapalua Ritz Carlton Hotel
- Kaua‘i Invasive Species Committee
- Kaunoa Senior Center
- Ke‘anae Community Association
- King Kekaulike High School
- Konohiki
- Kula Kaia Puna
- Lahainaluna High School
- Lekelani Intermediate
- Maui Adventist
- Maui Aids Foundation
- Maui Association of Landscape Professionals
- Maui Chapter of Kiwanis International
- Maui Community College
- Maui Early Childhood Educators
- Maui High School
- Maui Nui Botanical Garden’s Earth Day
- Maui Police Department
- Maui Waiena School
- Montessori
- Nā Ala Hele National Trails Day
- National Biological Information Infrastructure Conference
- Pacific Disaster Center
- Pacific Whale Foundation
- Pukalani Elementary
- Pukalani Elementary
- Pūnana Leo o Maui Preschool
- Saint Anthony’s
- Seabury Hall
- St. Ann’s Youth Group
- Trinity Western University of British Columbia
- University of Hawai‘i
- Upcountry Homeschoolers
- Upcountry Rotary Club
- Upcountry Youth Center
- Waimalu Elementary School
- Women In Conservation
- ‘Oahu Crow Tribe of Indian Guides of America
- Youth Vision 2000